MANUAL
of
ARTIFICIAL LIMBS

A. A. MARKS
NEW YORK

MANUAL

OF

ARTIFICIAL LIMBS

COPIOUSLY ILLUSTRATED

Artificial Toes, Feet, Legs, Fingers, Hands, Arms, for Amputations and Deformities, Appliances for Excisions, Fractures, and Other Disabilities of Lower and Upper Extremities, Suggestions on Amputations, Treatment of Stumps, History, etc., etc., etc.

AN EXHAUSTIVE EXPOSITION OF PROTHESIS

A. A. MARKS
702 Broadway, New York, N. Y., U. S. A.
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PREFACE

[ANUAL OF ARTIFICIAL LIMBS is the title given to this book to inguish it from the Treatise and all other publications which it ceeds and supplants. It is in no sense a catalogue, although con-ing the information usually given in catalogues; but it is a manual of the subject of prothesis and the most exhaustive k ever produced on that topic. Prothesis or prosthesis is defined Webster as "The process of adding to the human body some ficial part in place of one that may be wanting."

he Manual thus treats of all losses and impairments of the ex-nities, whether caused by accident, disease or birth, shows what are and clearly describes how they may be repaired by artificial hods.

he Manual is divided into chapters, each devoted to a distinct se of the subject or to a particular part of the leg or arm under ussion.

he illustrations are designated by letters and numbers for con-ience of reference. For example, partial foot amputations are ussed in Chapter III, and the illustrations in that chapter all e the letter C and are numbered in order, 1, 2, 3, etc. Amputa-s of different sections of the legs and arms are similarly divided the illustrations numbered in the same manner. This gives niteness and avoids confusions with earlier publications.

he need of the Prothesist becomes more and more urgent every Losses of limbs by accidents and injuries of every kind are stantly multiplying, and the demands made upon the thought-and skillful maker of artificial limbs and other surgical apparatus ease in the same proportion.

ne successful maker cannot confine himself to the narrow hods of former times. Specific treatment is now called for in ost every case, the peculiarities of each requires closer study, rate methods must be devised by which complicated cases can reated more skillfully and reparation more complete. These advanced methods, called for by the progress of the science and ssitated by the importance of the work required. The skillful er thus occupies a much more prominent position than can be d by those who persist in clinging to archaic systems. It has said by those most competent to judge that the house of A. A. ks through persistent endeavor, broad enterprise, attentive study a real sense of the importance of the work has earned and occu-the foremost position in its branch of industry.

While the loss of a limb is a serious personal deprivation, it is no longer regarded as a grievous or irreparable one. There are many thousands of people who walk, work and mingle with other people without disclosing their own loss and without suffering. The absence of a leg or an arm, therefore, is now regarded, and quite rightly, as one of the minor misfortunes. Testimonials substantiating these statements, and explaining and endorsing the principles presented in this Manual for the construction of artificial limbs, will be found in copious numbers in Chapter XXXVII.

TABLE OF CONTENTS

CHAPTER IV

CHAPTER V

CHAPTER VI

CHAPTER VII

CHAPTER VIII

CHAPTER IX

CHAPTER X

CHAPTER XI

CHAPTER XII

CHAPTER XVII

CHAPTER XVIII

CHAPTER XIX

CHAPTER XX

CHAPTER XXI

CHAPTER XXII

CHAPTER XXIII

CHAPTER XXIV

CHAPTER XXV

CHAPTER XXVI

CHAPTER XXVII

CHAPTER XXVIII

CHAPTER XXIX

CHAPTER XXX

CHAPTER XXXI

CHAPTER XXXII

CHAPTER XXXIII

CHAPTER XXXIV

INTRODUCTION

In reviewing "Manual of Artificial Limbs" and introducing same to the reader privilege is taken to advert briefly to the House itself and its enviable history.

The house of A. A. Marks was founded for the sole purpose of relieving and helping the maimed and deformed. Established in the year 1853 it has had an unbroken existence of over seventy years and is to-day as it has been for many years the leading house of its kind in the world.

Its manufacturing plants, the factory and office in New York City, the mill and storehouses out of town, occupy more ground and keep more men employed than all the artificial limb manufacturers in the United States combined with the exception of but a few. The business is a large one, conducted in a large way and by men thoroughly trained with every detail of artificial limb construction.

Their specialty is the making of artificial legs and arms with rubber feet and hands, of which they are the inventors and patentees. The spring mattress rubber foot and the rubber hand with ductile fingers are valuable improvements. That the house has grown from a small shop to a vast manufacturing establishment with a hundred thousand correspondents located in all parts of the world is due not only to the intelligent way in which its business has been conducted, but to the inherent merits of its products. These are described at length in the pages that follow.

Modern skill has brought no more useful aid to humanity than the artificial limb which transforms a helpless dependent into a useful member of society.

The firm does not claim that every maimed and crippled person can be restored to the full functioning of the lost parts. It does, however, claim that its skill and facilities help the maimed to a gratifying degree.

This book has been prepared not only as an exposition of the firm's business but as a guide for the mind of the reader in seeking amelioration.

The firm manufactures limbs for simple amputations as well as for the most complicated and difficult ones. It has developed special types of limbs for groups of special cases, many of which are

of utmost complexity; it has fitted and helped persons with delicate and tender stumps, also many with stumps of awkward shape and difficult forms; it has applied artificial limbs and appliances to persons with one sound limb as well as to those who have been deprived of both, and the volume of testimony it has on view received from its clients, filled with gratitude, stimulates it to continued endeavors.

The book is destined to be an authority on the important subject of prothesis, a book of interest and concern to the surgeon and physician as well as to the maimed. It contains not only a description of multifarious devices but much general matter both descriptive and critical, and in a way didactic, bearing close relations to the work of the surgeon.

It is a matter of highest gratification and pride that in all the exhibitions in which the firm of A. A. Marks has been represented it has received forty-six first and highest awards, always in competition with others. But the freely proffered expressions of regard and satisfaction from its clients, from the men and women who have been helped and whose lives have been aided and bettered through the use of its apparatus, are more stimulating, and the very highest measure of praise one can hope to receive. Numerous as are those that are printed, they constitute but a fragment of the kind and grateful words that have been uttered in its favor during its career.

The book will reach many readers. To them let us say one word. The firm of A. A. Marks has helped others. It surely can help you.

James Law, M. D.

CHAPTER I

HOW WE WALK

On Natural Feet.—No two persons walk exactly alike. Everyone carries his mannerisms in his steps. The way in which he lands on his heel, rolls on the sole, lifts on the ball, throws himself to the right or the left, the uniformity and regularity of each joint's action, the angle at which the hip is checked, the range of articulation permitted in the knee and the angular motion of the ankle,—all form a part of his individuality and make it possible to distinguish a friend from a stranger long before his features have come within the reach of vision. All sorts of forces—heredity, early habits, occupation, disease, injuries, and age—influence the movements of the leg and foot. A man in good health walks differently from an invalid, a farmer can be distinguished from a merchant, a bookkeeper from a railroad conductor, the sprightliness of youth, the infirmities of age are reflected in every step that is taken. Yet there are certain facts connected with walking that are common to all and which can be ascertained by observation and study. These facts are so universal that they become laws governing locomotion; they form a necessary part of the limb-maker's education, and unless he is familiar with them and applies them thoughtfully to the construction of artificial limbs, he is not competent to work out the problems that are continually arising.

As this work is designed as a text-book on artificial limbs, it is essential, at the outset, to present the cardinal facts relating to natural walking, in order that the application of them to artificial aids may be clearly understood and appreciated.

Kinetoscopic photography affords the most valuable aid to an investigation of the actions of the knee and ankle joints when performing their functions. It shows that when a man walks slowly, say two miles an hour, the knee flexes but slightly and the ankle considerably. When walking three miles an hour, the knee joint acts through a greater range and the ankle joint through a lesser one. When walking moderately fast, say four miles an hour, the knee action becomes considerable and the ankle action scarcely perceptible. When walking rapidly, say five miles an hour, the knee action is increased and the ankle becomes practically rigid. When running the knee increases its activity, and the ankle reverses its action and throws the man forward by the ball of the foot.

The ratio that exists between the range of motion of the knee and that of the ankle is in proportion to the speed with which one moves. An impulse is had to walk slowly or rapidly, or to change

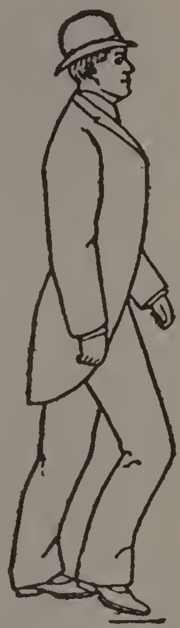
from one gait to another. The proper muscles and tendons instantly respond to the mind, and the required speed is attained. If the co-operation between the mind and muscles be disrupted the person becomes a paralytic and his steps are unreliable. The same may be said of a person walking on an artificial leg with ankle motion that is not under control.

Three miles an hour is the ordinary gait of a person occupied in

Cut A 1.

Cut A 2.

Cut A 3.



Cut A 4.

commercial life. Successive photographs of a man with natural legs, walking at this gait, show that there is but very little motion in the ankle joint; and limited as that motion is, it is of a character that cannot be imitated by mechanical means. The walker throws his left foot forward, barely touching the heel to the

Cut A 5.

Cut A 6.

Cut A 7.

Cut A 8.

ground, as shown in Cut A 1; instantly the right foot under control of the tendo-Achilles extends and the heel is raised from the ground, throwing the weight of the body on the ball, supplying the impetus that urges the body forward. As the body is carried

forward, the ball of the left foot reaches the ground at about the time the body is vertically over it, as shown in Cut A 2. At this point the right foot is in the act of leaving the ground, and, as shown in Cut A 3, is passing the left which, still being flat on the ground, performs no function, except that of supporting the body, as shown in Cut A 4. The right leg is carried a little further forward when a slight amount of flexion is admitted in the left ankle joint, as shown in Cut A 5. But this is for a very brief period, as Cut A 6 shows that the tendo-Achilles instantly contracts and the foot extends and the entire body is lifted and thrown on the ball, and when the weight of the body is placed on the heel of the right foot, there is a slight flexion in the knee joint which permits the sole to reach the ground. At this time, the knee joint of the left is flexed and the foot of that leg is raised, as shown in Cut A 7, and when the weight of the body is practically over the right foot the knee is extended, so as to support the weight securely, as shown in Cut A 8.

A study of these successive photographs shows that in making a complete step the soles of both feet are not on the ground at the same time, and at times when the weight of the body is placed equally on each foot, the heel of the advanced foot and the toes of the rear foot are only those parts that are on the ground. It also shows that propulsion is obtained by rising on the ball of the rear foot.

On Artificial Feet with Ankle Joints.—Similar photographs of a man walking with one or a pair of artificial legs with ankle joints set to act at a constant range of motion, show that he walks fairly well at a slow gait, but at a speed of three or more miles an hour his step becomes perceptibly awkward, and the effort required to overcome the too liberal motion in the ankle is fatiguing. So far as the knee joint is concerned the motions of the artificial and natural legs are approximately the same, but the motions of the ankles are very different. The sole of the foot is flat on the ground for a considerably longer period with the artificial ankle joint than with the natural. As the walker advances and strikes the heel of the artificial foot on the ground, almost immediately the front of the foot drops and the entire sole rests on the ground and remains there during the interval through which the body is passing over it.

Having made plain the movements of the natural foot in walking, and contrasted them with the movements of the artificial foot articulating at the ankle, we now propose to carry the contrast to the spring-mattress rubber foot attached rigidly to the leg socket.

On Spring-Mattress Rubber Feet without Ankle Joints.—As the walker advances on the rubber foot he touches the heel to the ground. He applies his weight, and the sponge rubber in the heel compresses sufficiently to allow him to roll on the bottom of the foot; the moment the body is carried a little in advance, he rises on the ball very much the same as he does on the natural foot. There is no effort required to lift on the ball, as the weight

of the body, being in advance of its center of gravity, overcomes that apparent obstruction; not a muscle or tendon is brought into play; the weight of the body does the entire work.

These studies and comparisons of the movements in walking bring out very clearly the essential fact that with the artificial ankle joint the interval that the plantar surface rests on the ground is very much greater than that of the natural foot, while with the sponge rubber spring-mattress foot it is approximately the same, and, by compelling the walker to rise on the ball, produces a very natural action, giving greater assistance in walking and dispensing with a vast amount of mechanism.

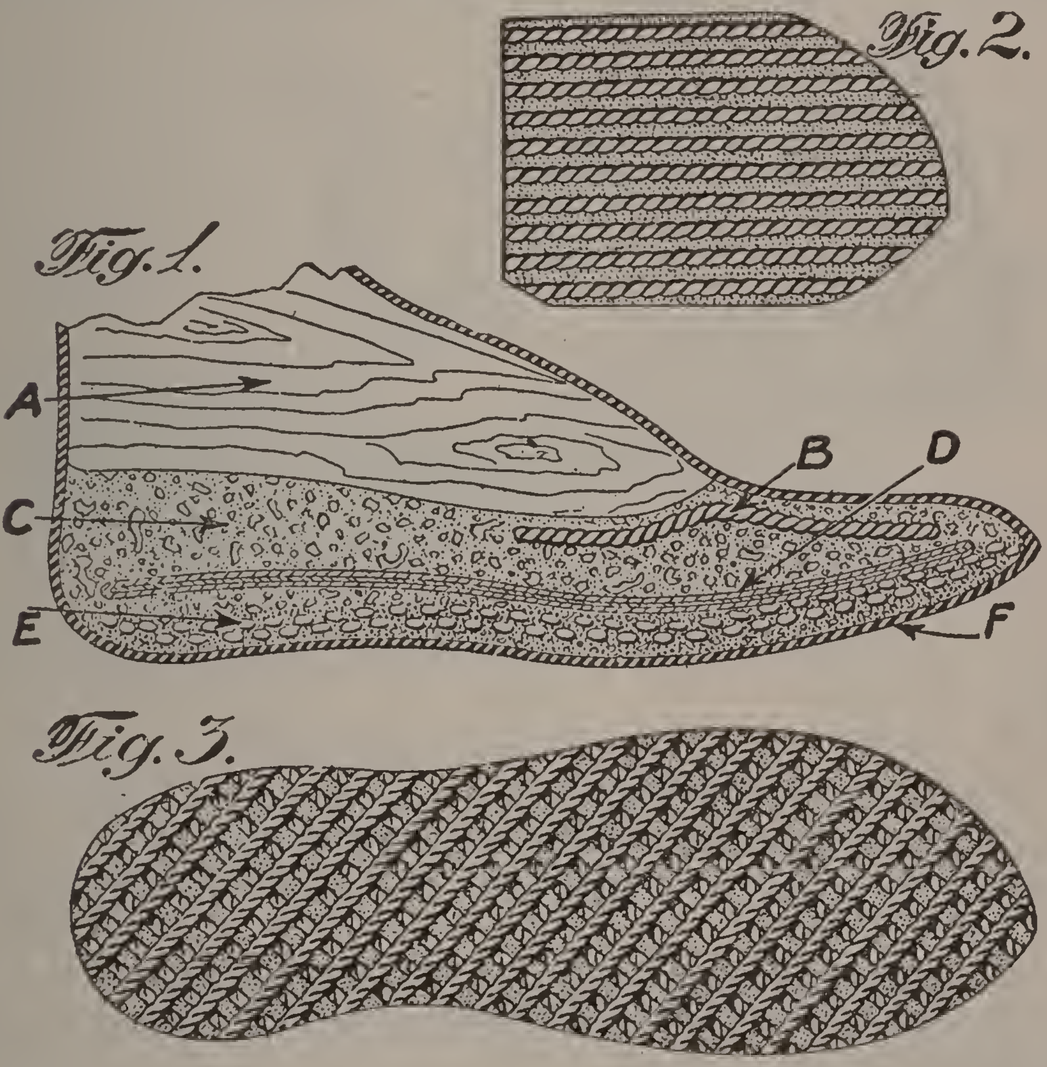
It is apparent also that the value of mental force in controlling the actions of the natural ankle joint cannot be overestimated. When these forces become inert, as they necessarily do in artificial joints, the embarrassments that follow are the same as with paralytics, locomotor ataxia, etc. The injured are obliged to walk cautiously, the affected foot is placed almost entirely by the sense of sight, and the step is made with meditation and progress must necessarily be slow.

If an artificial leg with ankle articulation be applied to a person who desires to walk at a gait faster than two miles an hour, he will find himself not only greatly hindered, but required to put more energy into the natural foot and leg in order to overcome the influence of the articulating ankle in retarding his progress. The rubber foot without ankle joint will assist rather than hinder rapid walking, and will not hinder slow walking when desired.

CHAPTER II

ARTIFICIAL FEET, THEIR CONSTRUCTION AND RELATIVE MERITS

THE CORDED RUBBER FOOT.—With an experience of eight years in manufacturing artificial legs with wood feet, articulating at the toes and ankles, A. A. Marks in 1861 invented the sponge rubber foot, to protect which the United States Government issued letters patent in 1863. Like all great inventions it passed through various stages of development.



In July, 1921, we entered into experiments for the purpose of adapting the principle of the corded tire used on automobiles to the rubber foot, thereby imparting to it those excellent qualities that have made the corded tire more elastic and far more durable. The results of our experiments have been most gratifying.

For better understanding, we will take a Corded Rubber Foot with Spring Mattress and split it lengthwise, the interior with all its parts will be exposed to view.

Fig. 1 shows the foot with weight equally applied to heel and ball.

Fig. 2 shows a corded re-enforcement, made of strong Sea Island

Cotton Cord imbedded in pure gum rubber. This is placed under the end of the core, marked B. This re-enforcement receives all the weight of the wearer when applied to the front of the foot, distributing it over a very large surface, thereby preventing the core from working its way into the rubber and displacing the toes.

Fig. 3 represents the corded inner sole which is made of hard twisted Sea Island Cotton Cord laid in two rows, one crossing the other and both obliquely to the line of the foot, the spaces between the cords are ¼″ square and filled with elastic pure gum rubber thoroughly adhered to the cords; when walking the weight of the wearer is first on the heel, then on the ball; in either case the square spaces are pulled lengthwise and become diamond shaped, producing a pulling force which as soon as weight is relieved pulls the toes back to their proper positions. This corded inner sole is located in the foot very close to the outer sole, as shown in Fig. 4 by letter E.

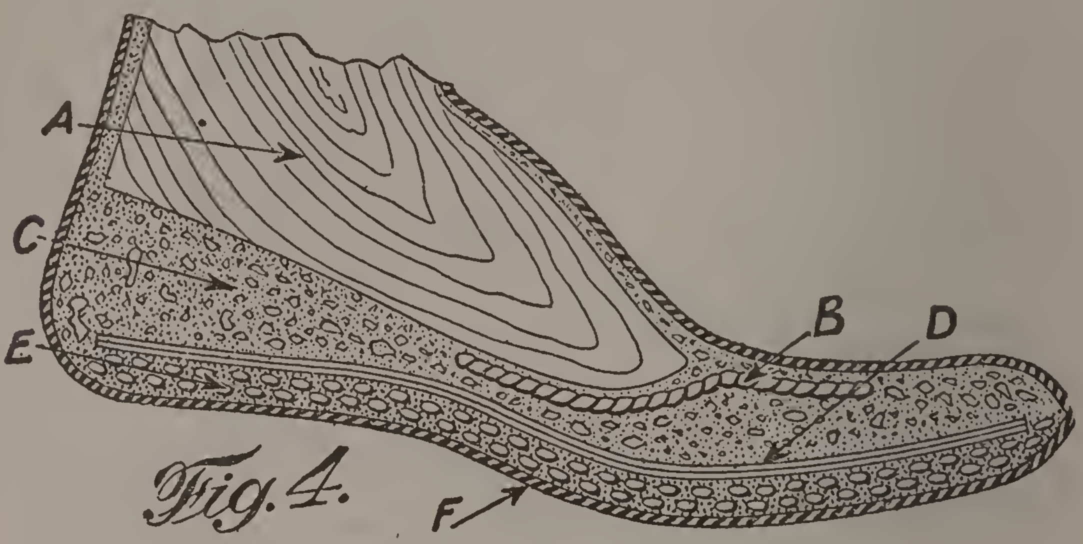


Fig. 4.

Fig. 4 shows the Corded Rubber Foot with Spring Mattress weight applied to the ball.

A, the base of the leg or core of the foot.

B, the corded re-enforcement as represented by Fig. 2.

C, represents sponge rubber of large porosity.

D, the spring mattress located immediately above the corded inner sole.

E, the corded inner sole in its proper position.

F, the sheet of Pure Gum Rubber which completely surrounds the foot.

With the exception of the corded re-enforcement B, under the forward part of the core, and the corded inner sole E, placed under the tread, the rubber foot is the same as it has been for years.

The number of clients now walking on the corded rubber foot with spring mattress are many. The easy tread and quick response of the toes at every step together with the assurance of durability are accomplished results long sought after. Patent granted June 20, 1922.

Cut B represents the foot on an inclined surface. On account of the yielding quality of the rubber, the up-hill side of the foot

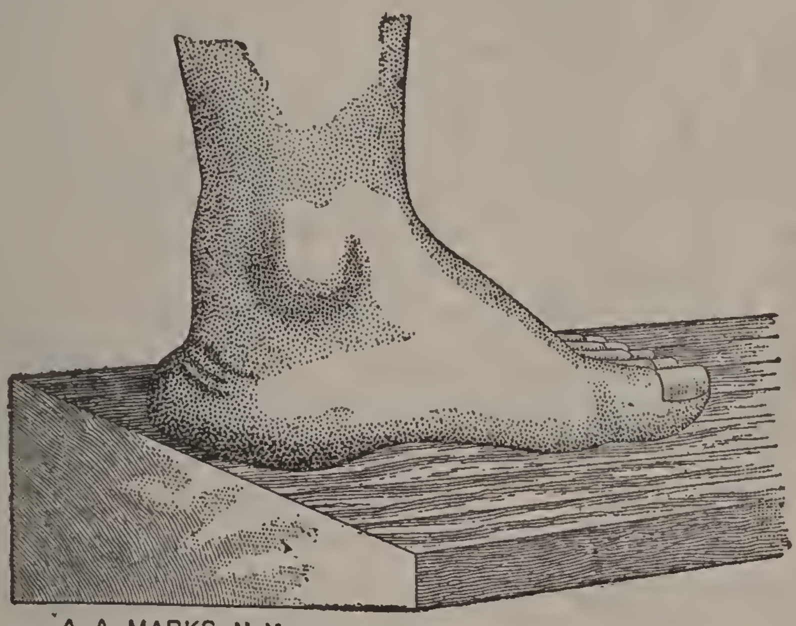
will compress and accommodate itself to the incline and allow the foot to remain on its base. This is accomplished without complicated mechanical lateral articulation.

The spring mattress not only forces the parts of the foot back to their proper shape, but obviates the exertion required to operate the antiquated articulated wooden foot.

The impression that one receives on the new spring-mattress foot is both pleasant and agreeable. This is especially the case to one who has worn an artificial leg with wooden articulating foot.

It can readily be seen that any motion in the ankle that cannot be controlled by the will must be mechanical in appearance as well as in action. The approach to nature is made more positive by their omission.

It is the experienced man, the man who has experimented with many kinds of artificial limbs, who is capable of appreciating the



Cut B 4.

principles involved in the rubber foot. He comprehends the reason why the wearers of artificial limbs with rubber feet walk further, faster, and with less fatigue, than those walking on ankle-jointed wooden feet.

The contrast between the two kinds is most striking in running. With the rubber as with the natural foot the entire plantar surface is never on the ground. It is the heel-and-toe touch to the ground that distinguishes the walker from the runner. This is extremely difficult with the ankle-jointed foot. When standing the immovably attached rubber foot furnishes a large base on which to balance; hence, a man with two artificial legs with immovably attached feet can stand restfully and safely without assuming awkward and unnatural positions, for he is not required to maintain his equilibrium on a point.

The rubber foot with spring mattress provides the laborer a substantial substitute with which to support and brace himself when working at the bench, on the road, on the farm, or at what-

ever occupation he may be engaged. There are no uncertain or treacherous movements to hamper him or make his position uncertain.

A painter who wears a Marks rubber foot says he can climb a ladder, stand on a scaffold, balance himself at any elevation with absolute safety. With an ankle-joint leg he would feel tottlish, and, when on his ladder, would have to depend more on the grasp of his hands than on his foot; but, with the rubber foot, his base is substantial and reliable.

A farmer who toils in the field can plod along over stony or muddy ground on a rubber foot with safety. The accumulation of mud on his shoes does not cause his toe to drop and trip him. Uneven surfaces will not throw him from his balance or violently jar his stump. We have thousands of testimonials on these points.

Contrasts.—There are two kinds of rubber feet. One is known as the sponge rubber foot; and the other as the pneumatic rubber foot. We will endeavor to make clear the difference between them.

When rubber is cured so that it possesses a great number of small air cells, the same as a sponge, it is called sponge rubber, and a foot made in this way is known as a sponge rubber foot.

A foot made of a sheet of rubber cast into the shape of a foot, possessing one or a limited number of large chambers into which air is pumped until sufficient pressure is obtained to maintain shape and possess resiliency is called a pneumatic foot.

The Sponge Rubber Foot.—Is composed of a vast number of cells, each charged with air created by the volatilization of a chemical while the rubber is being vulcanized. Each cell is surrounded by a wall of rubber possessing a sustaining power sufficient to maintain itself should it become deflated. In fact, if all the cells become deflated the foot would keep its shape on account of the presence of the sustaining walls, therefore the shape and resilience of the sponge rubber foot are not dependent upon the air in the cells.

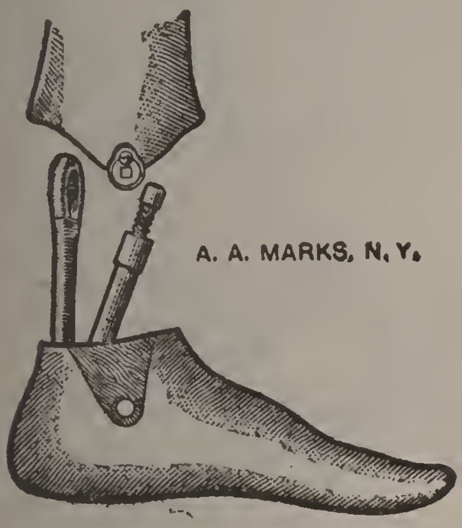
The Pneumatic Foot.—Having but a limited number of large air chambers into which compressed air is forced, is wholly dependent upon the presence and retention of the compressed air for its stability. The sponge rubber spring-mattress foot receives no injury from puncture. The pneumatic foot will collapse and lose its sustaining power the moment the air chamber is penetrated. A protruding nail or peg in a shoe will puncture a pneumatic foot and put it out of service until the puncture is patched and the foot pumped up again with air.

The sponge rubber foot never has to be recharged with air.

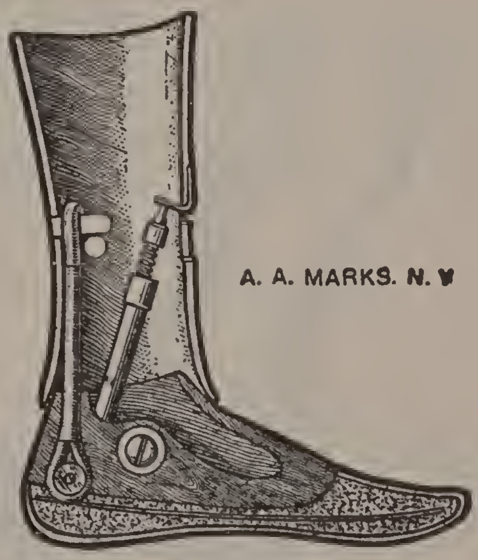
The Wood Foot.—Is now somewhat antiquated. Like the hard tire of the carriage wheel of yesterday it no longer holds the position of importance it had for many years—rubber is rapidly supplanting it. The wooden foot articulating at the ankle and the toes is a mechanical contrivance, very complicated and therefore very easily disarranged. The methods of construction are as varied as the makers who manufacture them. Nearly every maker

has a type of his own, yet all are essentially the same. Some admit of a large range of ankle articulation, while others limit it so that there is but very slight motion. Some have side motion; others, equally as conscientious, condemn that motion and employ only front and back motion. Being convinced by most careful study and experimentation that an artificial leg is improved in proportion to the abridgment of its mechanical movements, we dissuade all from using the side motion. Some manufacturers employ rubber for springs in the ankle and toes; others prefer steel. One method has little advantage over the other.

THE ANKLE-JOINT RUBBER FOOT.—Cut B 5 represents an ankle-jointed rubber foot after our preferred plan. Cut B 6 represents



Cut B 5.



Cut B 6.

the ankle articulation in sectional view. The axis on which the foot moves consists of a bolt that passes through the foot at the ankle, connected with steel strips riveted to the lower sides of the leg. A steel spiral compression spring, one end of which is placed in a cylinder and the other, receiving a piston, is placed in the ankle in such manner as to act on the rear part of the foot, impinging against the front interior part of the socket, forcing the heel downward and the front of the foot upward. The articulation at the ankle is limited by the check cord placed in the rear. It is made of the strongest flexible material. This method of articulation can be used with wooden feet as well as rubber ones. When rubber is used it is not necessary to have a mechanical articulation at the base of the toes as the rubber itself will furnish that motion. Cut B 7 represents the ankle at extension, the foot flat on the ground when the leg is thrown forward and weight applied. Cut B 8 represents the ankle at flexion and weight applied to the toes.

THE FELT FOOT.—Is so seldom used that it is only referred to here in order to make our descriptions complete. Its use is to be strongly condemned. Felt possesses no stability. It is an absorbent of moisture and lacks resiliency, and is therefore wanting in the most essential qualities that should characterize the material used in the construction of an artificial foot.

Ankle Joints when Preferred.—While many years of observation and study have convinced us that the best results are obtained from artificial legs with rubber feet rigidly attached, it is nevertheless true that some persons form prejudices that cannot be removed even by the most logical arguments. Another class, who may be put in the same group, are those who, for a long period, have worn artificial limbs with articulating ankles; and have become so inured to them that a change, no matter how beneficial it might ultimately prove, would subject them to annoyance. We care not to antagonize those who think and feel this way; we are therefore prepared

Cut B 7.

Cut B 8.

to construct artificial legs for them that are similar in construction to those they have worn and have become accustomed to.

We frequently hear of persons who are inclined to patronize us on account of the reputability of the house, but who hesitate in doing so on account of their doubts as to whether they themselves would make a success with artificial legs without ankle articulations. The idea of the rubber foot is acceptable, but rigidity at the ankle is doubtful. The element of doubt hinders their entering into any experiment the success of which is entirely at their risk.

We are disposed to meet any such person on a basis of equity and will funish him with an artificial leg with rubber foot rigidly attached at the ankle with the understanding that, if after reasonable trial he feels that he would prefer the ankle joint, we will apply one for him without extra charge.

As we regard rubber feet rigidly attached at the ankle better for general purposes, we make limbs that way unless otherwise instructed.

Prices are the same whether rubber feet are permanently attached or made to articulate, whether feet are of wood, metal, or rubber.

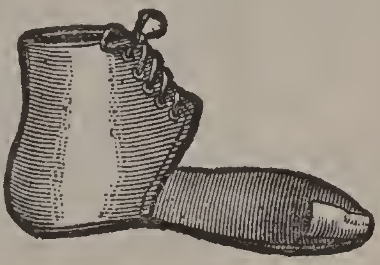
CHAPTER III

PARTIAL FEET AMPUTATIONS

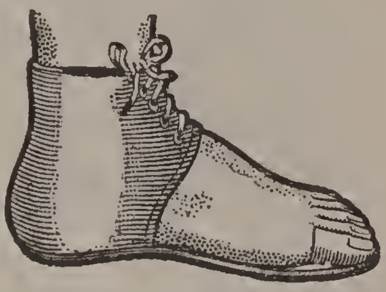
Single-Toe Amputations.—The loss of a single toe, particularly if it be the great one, may or may not be the cause of inconvenience and discomfort, yet the application of an artificial part is often found necessary, both as an aid in walking and as a protection to the amputated surface.

If one or more of the interplaced toes are removed and the hiatus has been filled up by the union of the adjacent surfaces, there can be no gain whatever in applying artificial ones. If the great toe (see Cut C 1) or the small toe be removed, and the am-

Cut C 1.



Cut C 2.



Cut C 3.

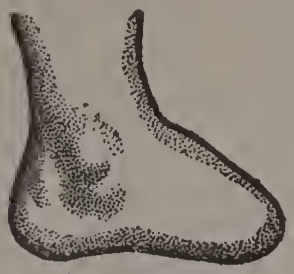
putated surface is tender and painful to the touch, an appliance similar to that represented in Cut C 2 can be advantageously applied.

This appliance consists of a duplicate of the removed part, made of suitable material and secured to a plate shaped as the sole of the foot. It is held to the foot by an incasement of leather, laced down the front; when applied it is ready for the shoe, as shown in Cut C 3. This simple arrangement protects the amputated surface, assists in walking, fills the shoe, and prevents unsightly wrinkles in the leather.

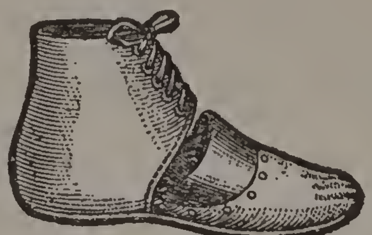
Amputations at Base of Toes.—It is necessary to apply an artificial part when all the toes have been removed, as shown in Cut C 4. It must be so constructed that it can be held in place and avoid pressure on the scarred surface. Shoes stuffed with cotton or with pieces of cork should never be used; such expedients, having no support on the under sides, will eventually encroach on the amputated surfaces and permit the shoe to bend near the ends of the stumps.

An appliance illustrated in Cut C 5 is suitable for such an amputation; it is shown applied in Cut C 6. It can be made of wood or metal as may be required, and shaped to receive the foot in a comfortable manner; tender points are protected by recesses pro-

vided for them. Cut C 6 shows this apparatus applied and ready for the shoe. Usually the mate to the shoe worn on the natural foot can be used without alteration; in cases where more room is



Cut C 4.



Cut C 5.

Cut C 6.

needed, almost any shoemaker can supply it by ripping off part of the upper and substituting a larger piece.

Instep Amputations.—These are termed tarso-metatarsal and medio-tarsal by the surgical profession, and are frequently designated by the names of the surgeons who first performed them, as Chopart, Lisfranc, Hays, Hancock, and many others. These amputations are performed with the object of sacrificing as little of the foot as possible, and retaining the heel and a part of the foot as a base on which the patient is supposed to be able to walk or stand. Although a person with the front part of his foot removed may be able to get about with an ordinary shoe, it is not long before he discovers that something is lacking and his locomotion impeded by the absence of the removed part. He may pack the vacancy in his shoe with cotton, cork, or other material, and may re-enforce the sole with a steel plate; but he soon finds that only partial relief has been obtained, and that there is an imperative demand for a substitute for the ball of the foot which will enable him to rise on and elevate his heel from the ground. Something is needed having great strength and that can be firmly secured to the remaining part of foot and leg.

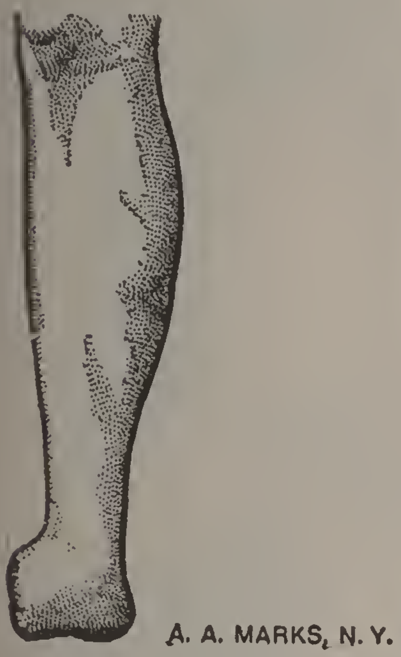
The construction of artificial feet for this class of amputations has taxed the ingenuity of artificial-limb-makers for many years. The absence of space between the bottom of the heel and the floor presented an obstacle to the construction of a helpful and durable appliance until aluminum was employed. It may be useful to review some of the devices used for such cases.

Cut C 7 represents a stump resulting from a partial foot amputation.

Ill-Advised Prothesis.—Cut C 8 represents the way in which many manufacturers have endeavored to supply the want. The appliance consists of a leather shoe inclosing the stump and part of the ankle, the front of which is made of wood, rubber, or cork with a metal plate at the base, running from heel to toe, calculated to make the sole firm and unyielding at the ball. This apparatus gives a natural appearance to the amputated member, but fails to support the wearer in a helpful or substantial way. The stump will soon crowd forward, coming into unpleasant contact with the

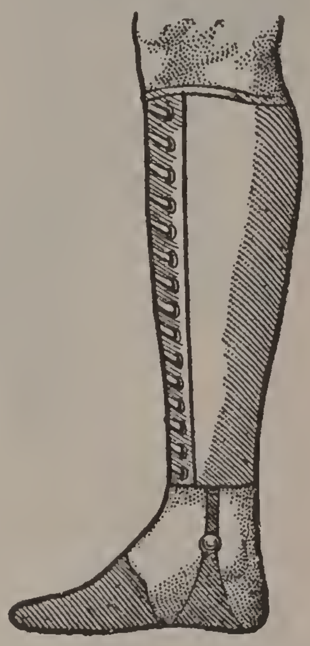
appliance; the steel plate will bend or break and the shoe will yield where the stump terminates, creasing the shoe and making it rocker-shaped; consequently it utterly fails in supplying the want, because of the lack of firmness with which it is held to the remaining part; the heel, moreover, will yield to the constantly contracting tendency of the tendo-Achilles and become displaced.

Cut C 9 represents another ill-advised apparatus. It consists of a sheet of metal formed to receive the remaining plantar surface



Cut C 7.

Cut C 8.



Cut C 9.

of the foot; bent up on either side, hinged at the ankle to steel straps thus providing a joint for ankle articulation; the steel straps run up the sides of the leg and are held in position by a leather corset, shaped to inclose the leg. The front of the metal sole is secured to a part of a foot. The main objection to this device is the insecurity of the attachment; weight applied to the ball of the foot will cause the ankle to flex and permit the amputated surface of the stump to rub against either the front or the bottom plate, causing abrasions; a heel cord placed at the back connecting the leg section with the foot plate will not be effective in holding the appliance in its proper position at all times and checking the action of the ankle articulation at the proper angle.

Objections.—A glance will show that the legs illustrated in Cuts C 8 and C 9 must prove inadequate. When weight is applied to the ball of the foot the heel of the artificial part will remain on the ground, while the heel of the stump will lift away. The wearer will walk flat-footed and will press the delicate cicatrized surface against the attachment. These conditions will not only cause suffering but defeat the object of the artificial foot.

It might appear that an appliance constructed on the plan shown in Cut C 5 could be secured so firmly to the remaining part of a Chopart stump as to enable the wearer to rise on the ball. If this were possible the method of treatment would be greatly simplified; unfortunately, however, the severity of the compression needful

to hold the appliance in place when weight is thrown on the ball, will stop the flow of blood in the heel, causing great pain, endangering the health of the entire leg.

Cut C 10.

Cut C 11.

It is important to emphasize the fact that it is absolutely useless to apply any form of foot to a partial foot stump unless the artificial part is held so firmly that the wearer may rise on the ball of the

Cut C 12.

Cut C 13.

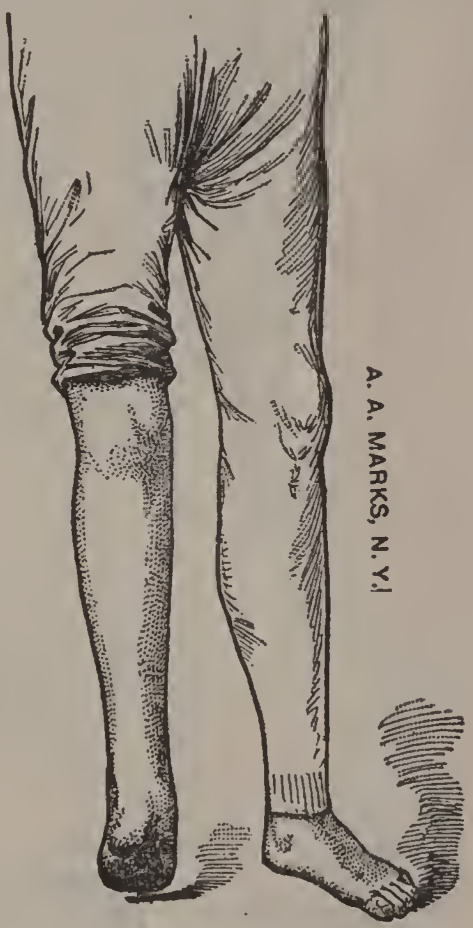
foot, and not only support his weight while in that position but carry such additional weight and resist such strains as his habits or occupation demand.

Cut C 10 represents an amputation a little forward of the instep.

The wisdom of the application of apparatus C 5 in this case is doubtful. It might prove adequate in the case of a person who does little walking and no lifting, and who places little demand on the front part of the foot; but for a laboring man, who has to lift and carry articles of weight, it would be a disappointment. It will be better considered, therefore, among instep amputations that require the placing and distribution of the strain above the ankle joint.

Cuts C 11, C 12, C 13, and C 14 show instep amputations after the Lisfranc, Hancock, and Chopart methods. Cut C 15 shows an

Cut C 14.



Cut C 15.

amputation of the instep with all the tarsals removed, a part of the astragalus and the entire os-calcis retained and kept in their normal relations, a very unusual occurrence.

The remaining plantar surfaces of each of these amputations are of a character to permit the application of the weight of the wearer on them.

Cuts C 16 and C 17 show instep amputations in which the heels have retracted slightly, but not so much so as to prohibit the application of weight to the remaining plantar surfaces.

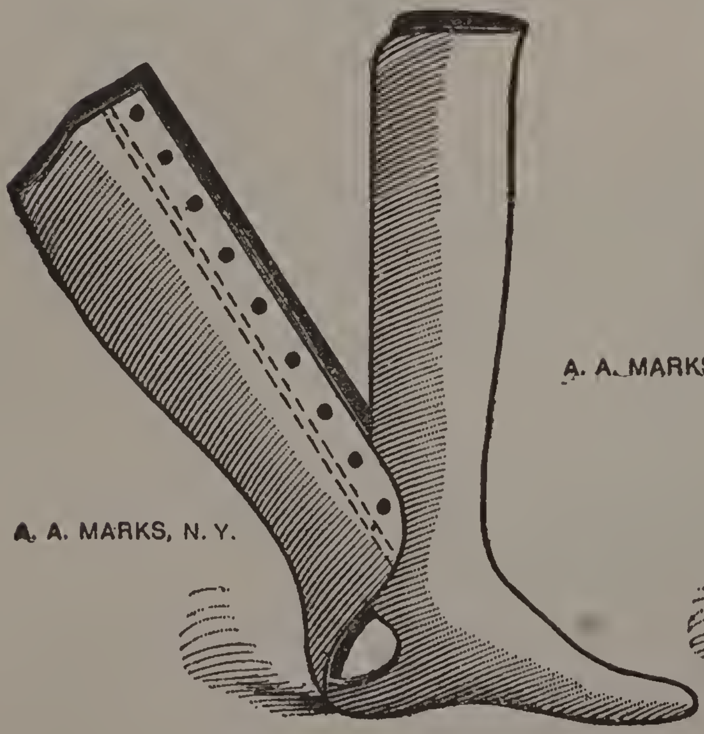
Practical Prothesis.—The only artificial limb that has ever been devised that adequately meets the needs of any of the above instep amputations is illustrated in Cut C 18. A half leg, or front, including the core of the foot, is made of aluminum, without articulation at the ankle. The rear half is made of leather, shaped to incase the leg and the aluminum shell and hold the appliance in place, as shown in Cut C 19. The sole of the foot, including the

toes. is made of rubber with a spring mattress as described in Chapter II. Comfortable bearings are provided by proper fittings

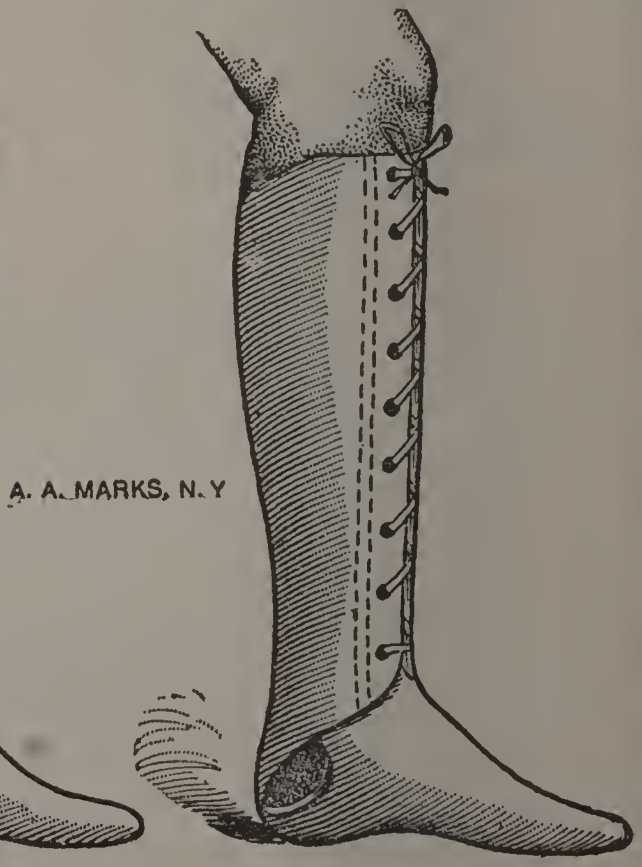
Cut C 16.

Cut C 17.

and suitable linings. The pressure needed to secure firmness is distributed over the entire leg from the ankle to the knee; with this



Cut C 18.

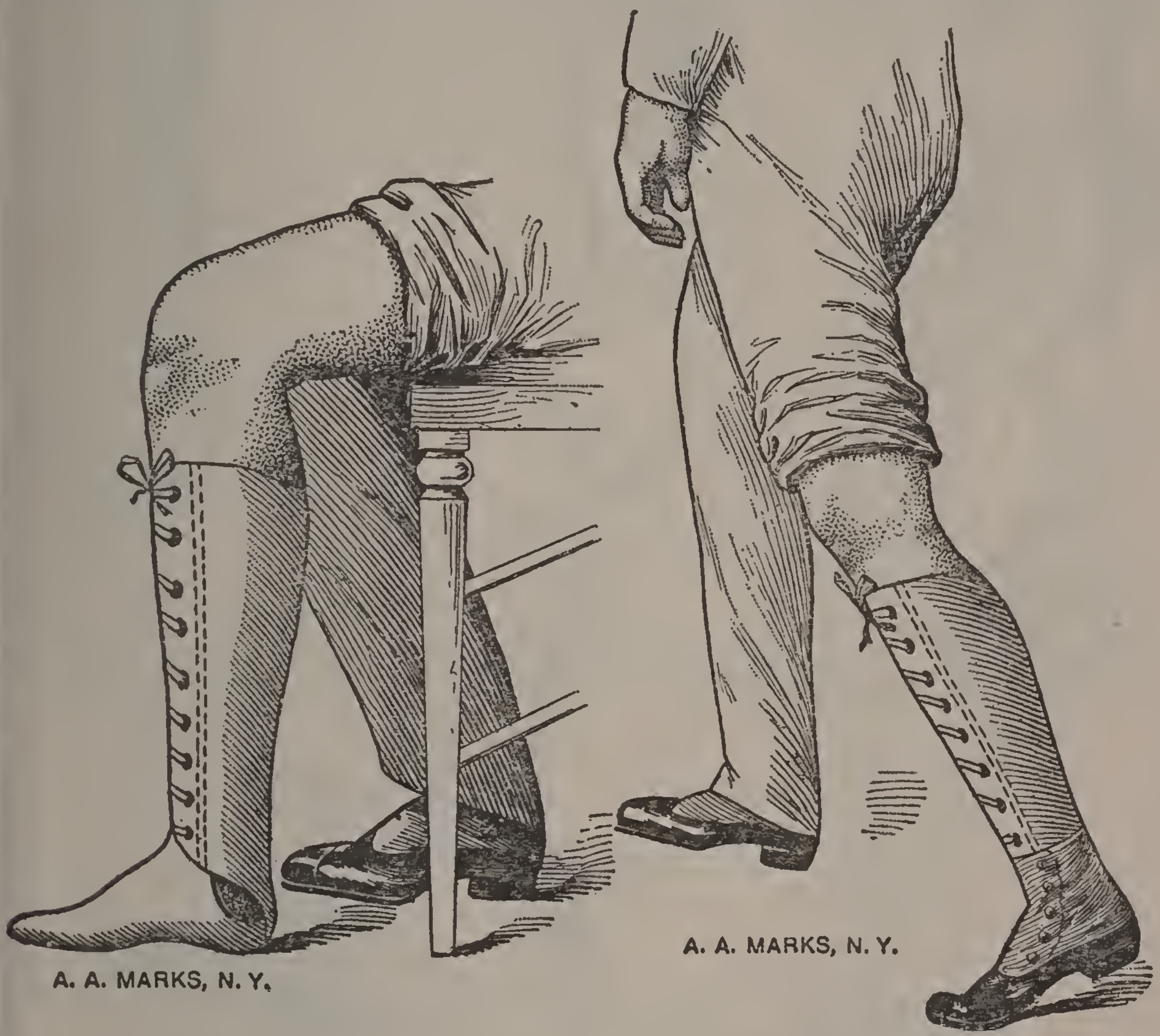


Cut C 19.

leg the wearer can rise on the ball of the foot without endangering the amputated surfaces or straining the ankle joint. The shin-

bone is protected by the aluminum shell on the front, and, when dressed, presents an appearance very close to nature. When there is a tendency for the heel to retract, the leather sheath at the back is re-enforced with metal shaped to hold the heel down to its proper place.

This artificial leg can be worn without inconvenience or pain. The wearer walks gracefully, striking the heel first, then rolling on



Cut C 20. Cut C 21.

the sole until the ball is reached, and then rising on the ball he receives assistance in walking. Cut C 20 shows the leg applied and the wearer seated. Cut C 21 shows the leg applied with the shoe on and the wearer walking with the weight on the ball of the foot, similar to the position taken by the natural foot when in the act of throwing the body forward.

The method of meeting instep amputations, as just described, possesses many merits aside from those to which attention has been called.

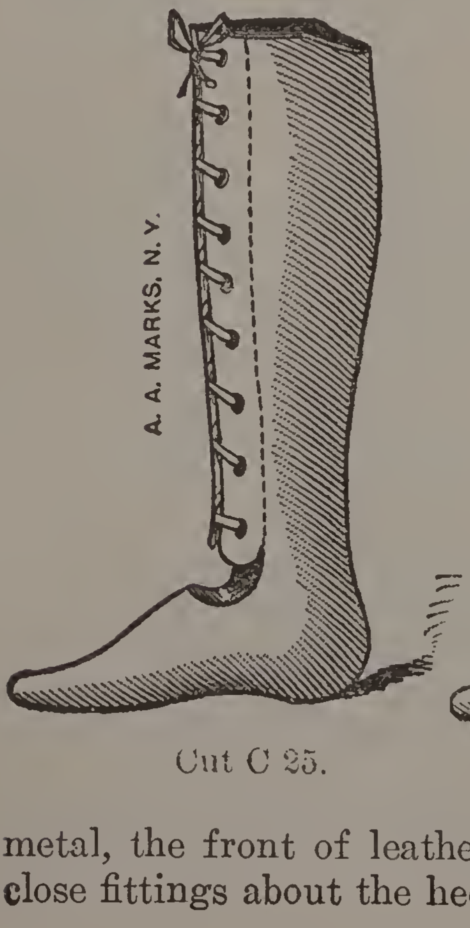
Retracted Heels.—Cuts C 22, C 23, C 24, show amputations in which the heels are retracted so that the amputated surfaces are directly under the legs, where the weight must be applied if the bearings are to be at the ends. These are unfortunate conditions. An artificial leg cannot be applied to a stump under such conditions that will permit any pressure on the scarred extremity; the weight, therefore, must be placed immediately below the knee or about the thigh.

Cut C 22.

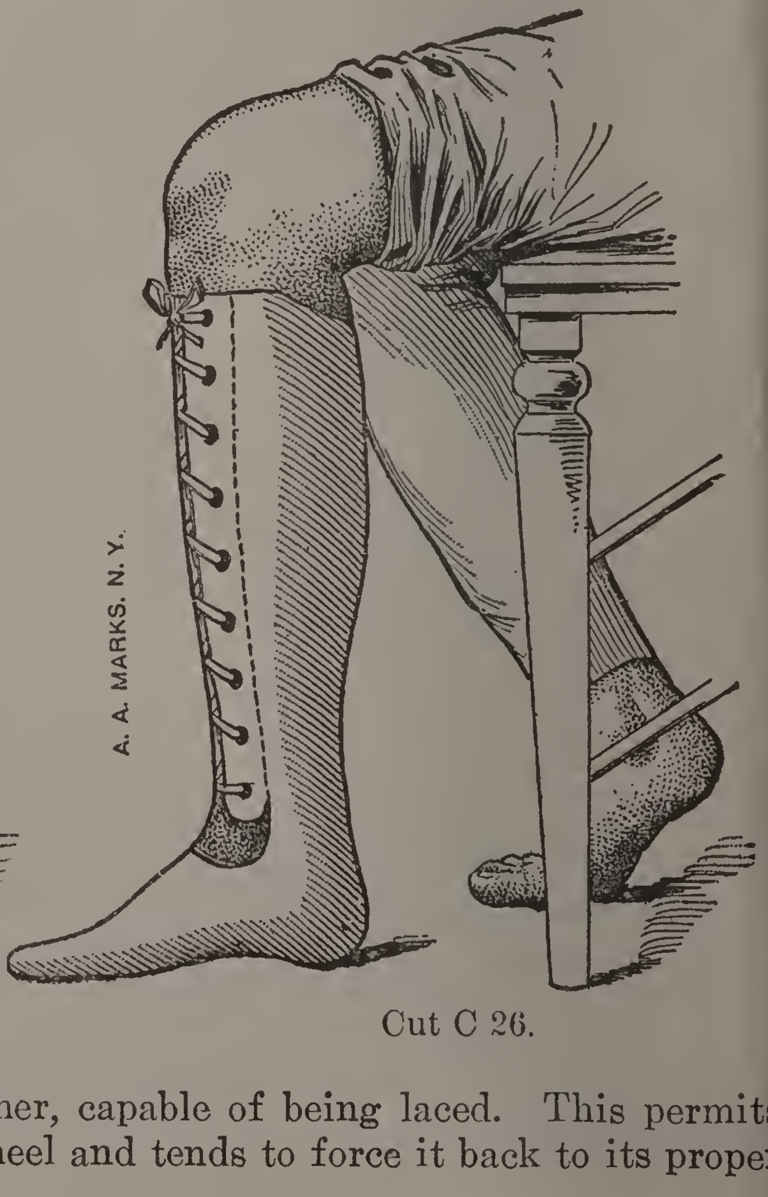
Cut C 23.

Cut C 24.

A limb constructed on the plan shown in Cut C 25 is adaptable for some stumps with retracted heels; the rear half is made of



Cut C 25.



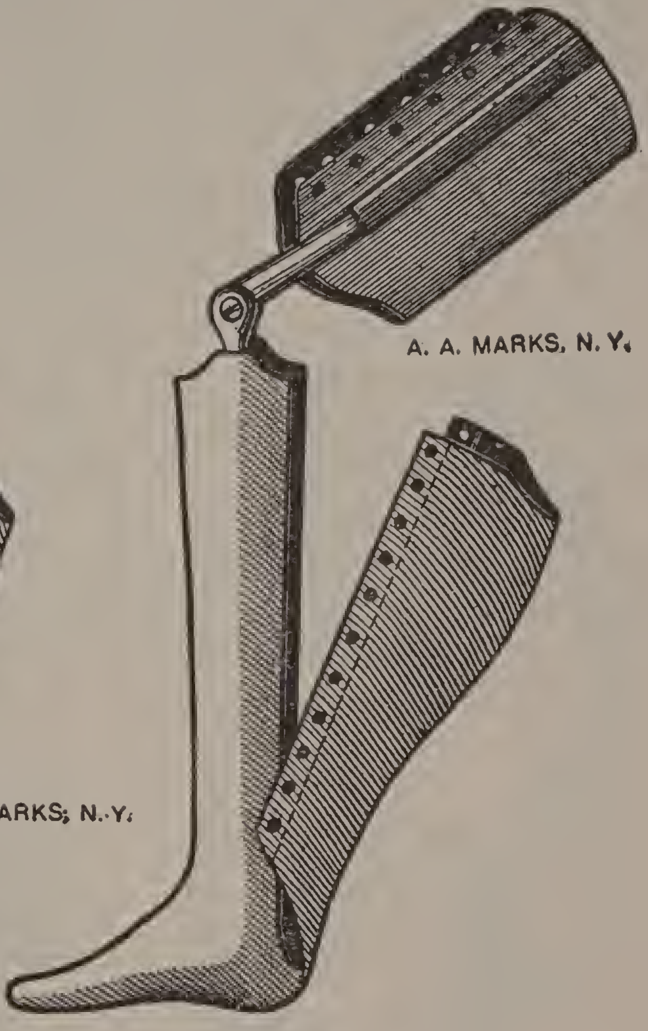
Cut C 26.

metal, the front of leather, capable of being laced. This permits close fittings about the heel and tends to force it back to its proper

position. If the sides of the leg are sloping, the fitting can be such as to apply all the weight on the leg immediately below the knee. Cut C 26 shows the leg applied and the wearer seated.

If the sides of a leg do not slope sufficiently to prevent settling into the artificial leg socket, it is necessary to introduce an annular top and possibly knee joints and thigh support. The annular top can be applied to a leg constructed as described; it then has the appearance of Cut C 27. It can also be applied to a leg constructed

Cut C 27.



Cut C 28.

on the plan of C 25. Knee joints and thigh support can likewise be applied to a leg constructed on the plan of either C 18 or C 25. Cut C 28 shows such additions applied to C 18 leg. When the annular top is employed the support is calculated to be localized immediately below the knee. The leg is opened from the rear and the stump inserted; the annular top is laced firmly and the leather sheath is pulled over the entire apparatus and laced in front. When the knee joint and thigh support are required, as shown in Cut C 28, the lower section of the leg is made of aluminum, with the rear sheath of leather. The thigh part incases the natural thigh and holds it with sufficient firmness to carry the weight above the knee and so prevent the leg from slipping in the socket.

Aluminum Sockets.—The utilization of aluminum in the construction of artificial legs for instep amputations is especially advantageous. It can be worked to a very slight thickness, thus adding but little to the diameters of the large stump that it

incases. A wood socket would require a thickness of at least half an inch on each side, thus making the leg conspicuously bulky and objectionable.

During the past few years we have made many experiments looking to the general application of aluminum in the construction of artificial limbs for upper amputations, but have met with disappointment except in ankle-joint and partial-foot amputations. The characteristics of aluminum are low specific gravity and comparative strength. Its weight is the least of all metals (one-quarter that of silver). Its strength is comparable with that of copper. It will not corrode when exposed to fresh water or to a moist atmosphere.

We desire to correct the prevalent impression often expressed in the remark that aluminum is "lighter than cork and stronger than steel." As a matter of fact aluminum will sink in water, whereas cork or wood will float; it is therefore heavier and although aluminum is strong, it has but a fractional part of the strength of straight-grained wood. Its use in artificial legs is, therefore, narrowed down to sockets for long and large stumps, where the minimizing of bulk is an important feature.

We hold United States patents on artificial limbs with aluminum sockets, and if we could make satisfactory use of that metal for general purposes we would unhesitatingly do so.

CHAPTER IV

ANKLE-JOINT AMPUTATIONS

Tibio-Tarsal Stumps.—Amputations through the ankle articulations with or without the maleoli, flaps formed of heel tissues, provide stumps that can be fitted with artificial legs in an advantageous way. Surgeons call these amputations tibio-tarsal or Symes, and if the os-calcis is retained and secured at the extremity of the tibia, it is known as Pirogoff's.

Usually ankle-joint amputations produce stumps that admit of weight being taken on their extremities. If cicatrices are on the

Cut D 1.

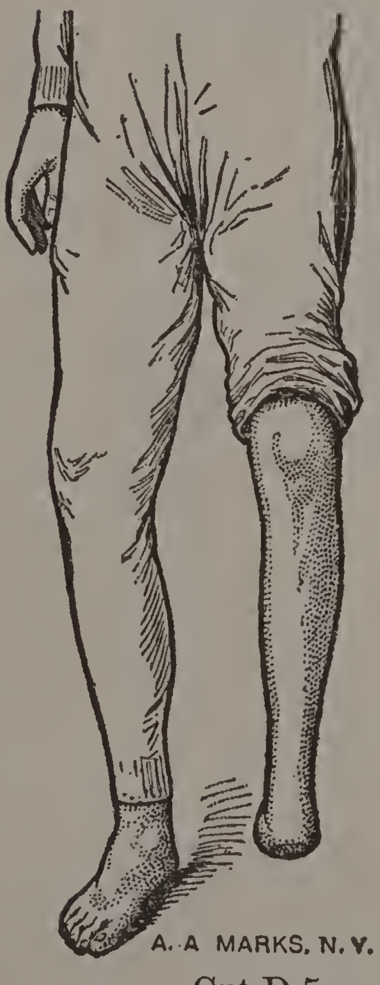
Cut D 2.

bearing surfaces or nerve complications are present, they become non-end-bearing and artificial limbs must be applied that permit no pressure or contact on the tender extremities.

End-Bearing.—Cuts D 1 to D 6 show end-bearing tibio-tarsal stumps, with flaps favorable for the application of pressure and with cicatrices well away from the bearing surfaces. Cut D 7 illustrates an artificial leg suitable for any of these types; Cut D 8 shows it applied with the wearer seated. Cut D 9 shows a Pirogoff stump with a suitable leg, patterned after style D 7. Cut D 10 shows the leg applied and the foot covered with stocking and shoe. Cut D 11 shows the wearer fully dressed. In walking his step is

Cut D 3.

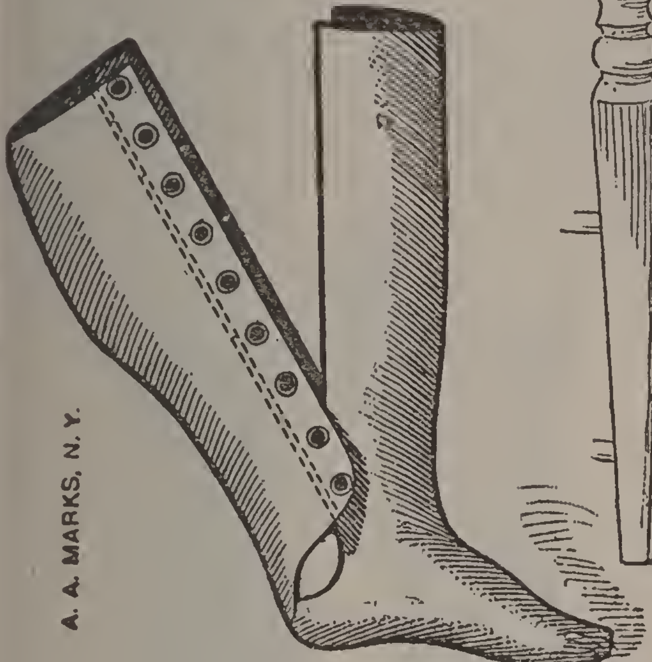
Cut D 4.



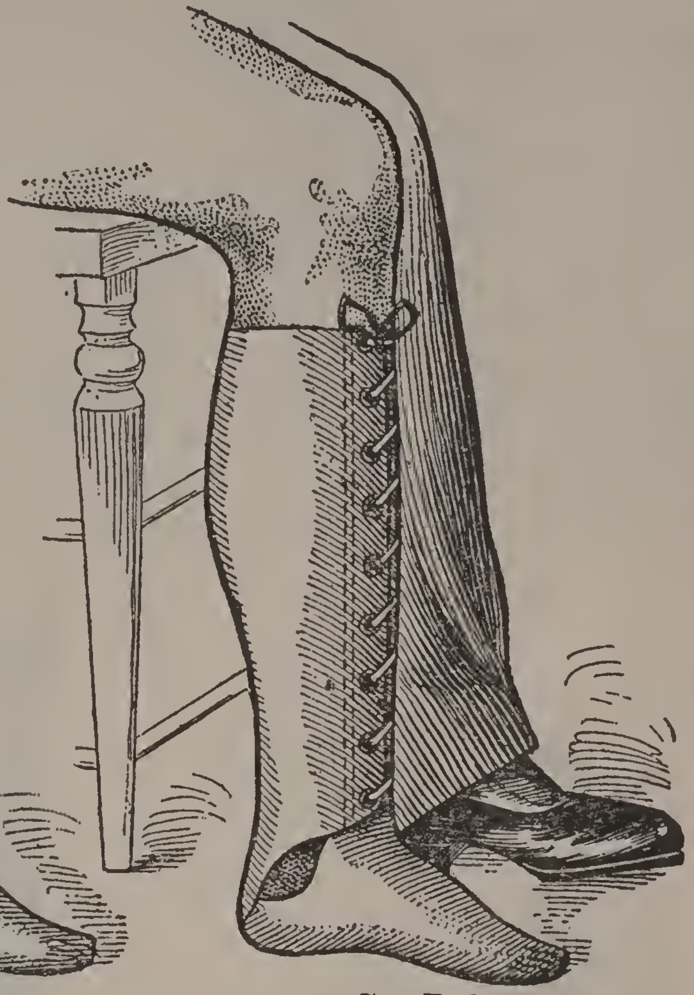
Cut D 5.

Cut D 6.

graceful, the foot imitates nature, there is no limping, and he is amply equipped to engage in any occupation, even the most laborious.



Cut D 7.


Cut D 8.

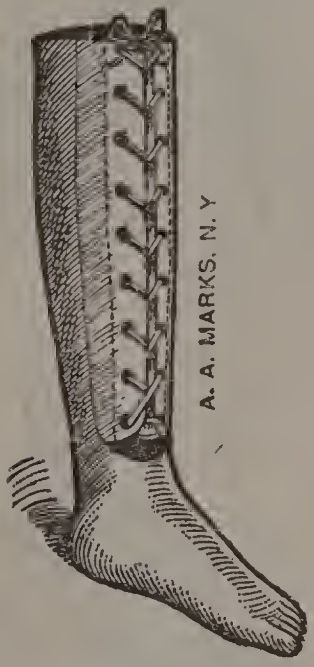
Cut D 9.

Cut D 10.

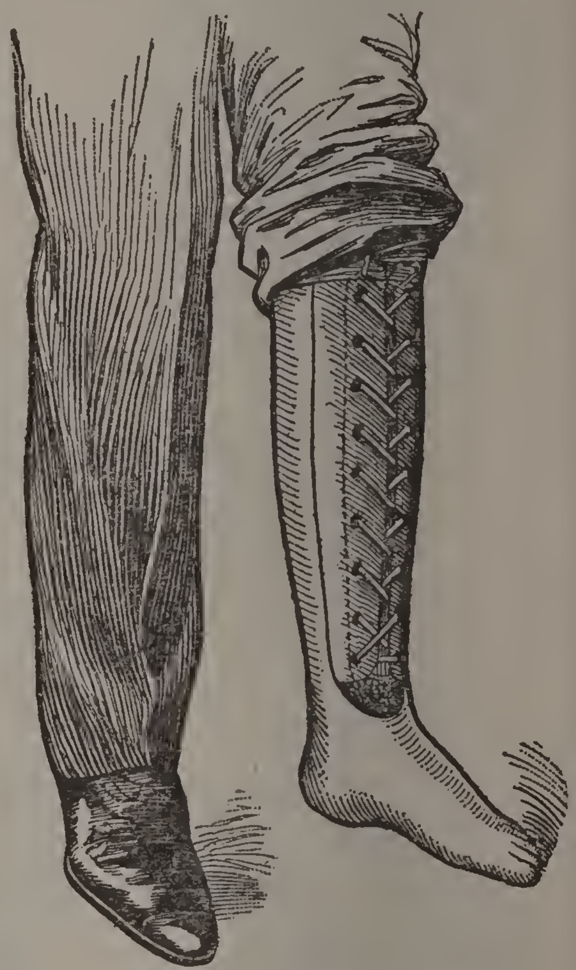
Cut D 11.

Construction of Suitable Artificial Leg.—The construction of D 7 style is simple. The front, which is the resisting part, and the core of the foot, are cast in aluminum, the interior surface being

formed to receive the anterior surface of the leg from the knee down. It is so fitted that pressure will be distributed over the front area, the shin bone and tender parts of the leg being protected and not allowed to bear pressure. The rear part is of leather, shaped to fit the calf and the back of the leg. It is secured at its lower end to the aluminum socket, and when the stump is in place it incases the whole apparatus from the knee down, holding the leg in place with firmness, the pressure being regulated by lacing. The foot is of sponge rubber, re-enforced with spring mattress as explained in Chapter II. Weight is taken by the end of



Cut D 12.



Cut D 13.

the stump resting on a surface of proper shape, covered by a suitable pad. The strains resulting from rising on the ball of the foot are not permitted to come on the stump; they are distributed over the leg, about the sides of the shin from the knee to the ankle. A stocking and shoe are drawn over the foot, and the apparatus is a counterpart in appearance to the sound leg.

This style of leg for ankle-joint amputation has received the most complimentary comments; it has given great satisfaction to those who have worn it; and it has been quite generally adopted.

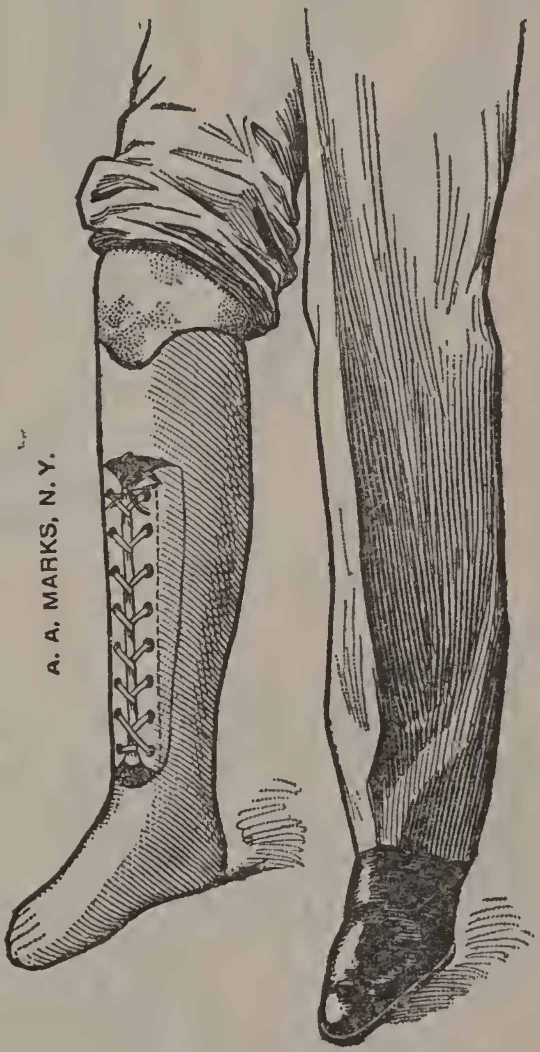
Occasionally conditions require the construction of a limb in a manner reverse to that just described, the stump is admitted from the front instead of the rear. In such cases limbs are built on the plan illustrated in Cut D 12. The construction is practically the same as D 7, except that the metal socket is placed at the back and the leather lace in front. The shin bone is protected by a padded

loose fly-piece over which the lacing passes. Cut D 13 illustrates the leg applied.

If the end of the stump is small and has no prominences on the side, the socket and core of the foot, which are integrally one piece, are carved from a block of wood the grain of which curves on the line of greatest strains. When the end of the stump is large and it is desired to incase it in a socket of minimum thickness, aluminum must be employed for reasons given.

Partially End-Bearing.—If only a part of the weight of the wearer can be borne on the end of the stump the top of the socket must be made annular and fitted so that it will impinge against the sloping part of the leg below the knee. Cuts D 14 and D 16

Cut D 14.

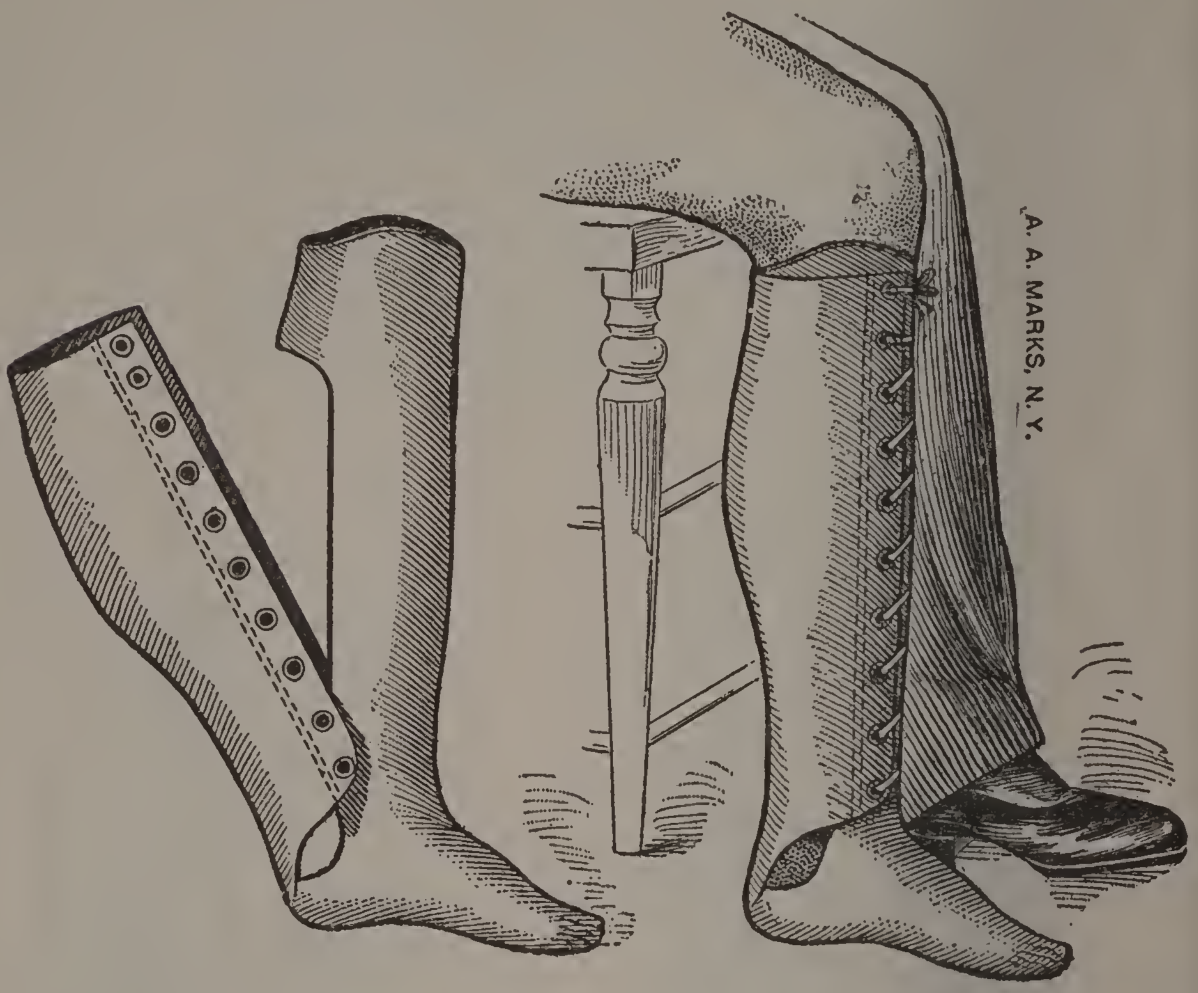


Cut D 15.

illustrate suitable legs for the same and Cuts D 15 and D 17 show them applied. It is obvious that a stump, being inserted from the top of the socket of either, will not enter further than the top of the socket will permit, and this is just far enough to limit pressure on the end or to avoid it altogether. When pressure can be taken on the end, it is regulated by the thickness of the pad placed in the bottom of the socket on which the end of the stump rests.

A socket that admits the stump from the front, as in Cuts D 12 and D 14, is objectionable when the end of the stump is very large. The material necessary for strength is on the sides of the stump and increases the diameter of the ankle. It also affords but little

protection to the sharp or sensitive shin bone. Styles D 7 and D 16 are not open to this objection, but give a smooth, unbroken



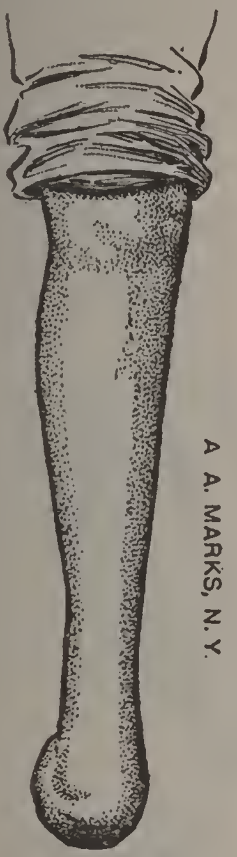
Cut D 16. Cut D 17.

front, which can be neatly dressed; they are lighter and stronger than D 12 or D 14, because the strain resulting from rising on the ball of the foot is carried forward from the point of contact to a point on line with the front of the leg: and as this point is usually halfway between the ball and the heel the strain is one-half of that applied in D 12, which throws the strain from the ball to the rear of the heel. For this reason the material on the sides of the stump and on the rear of the leg has to be as thick again as the material on the sides and front of the D 7. Hence the difference in weight.

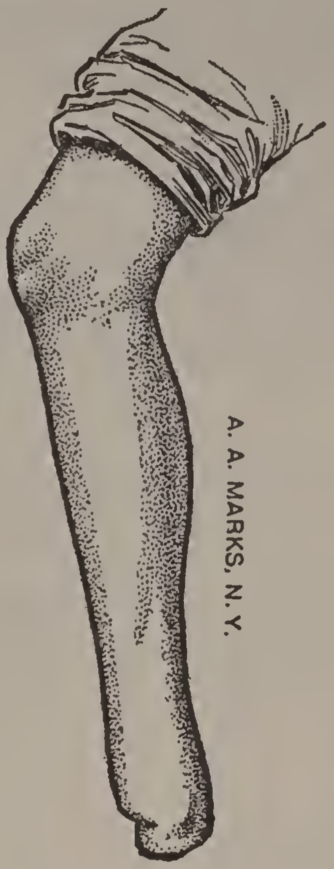
Sensitive Ends.—There are tibio-tarsal stumps that are so sensitive at the extremities that no pressure whatever can be tolerated either on the ends or at the sides of the ends. Notwithstanding this condition, artificial limbs can be applied that will be helpful and comfortable. Cuts D 18, D 19, and D 20 represent stumps of this character.

If the surfaces immediately below the knee are sufficiently sloping to offer resistance, D 14 or D 16 leg can be used, the pressure being placed on the sides of the upper half of the leg immediately below the knee. The stump from calf down hangs in space.

When a leg and stump are nearly uniform in size, the sides being parallel or nearly so, an artificial leg with knee joints and thigh piece must be used. Cut D 21 represents a leg suitable for such a case. Cut D 22 shows the same with knee flexed and sheath un-

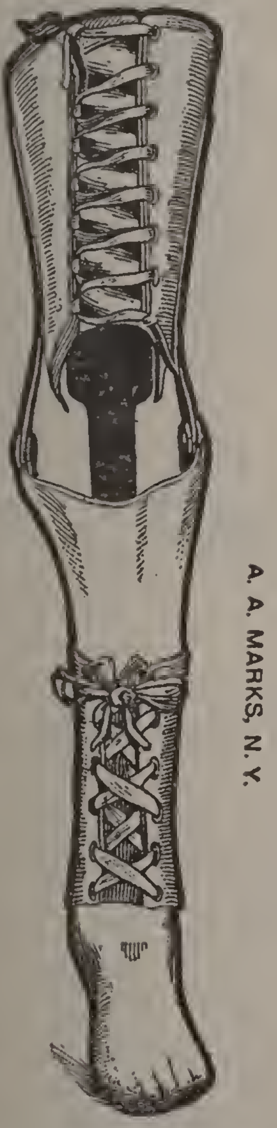


Cut D 18.

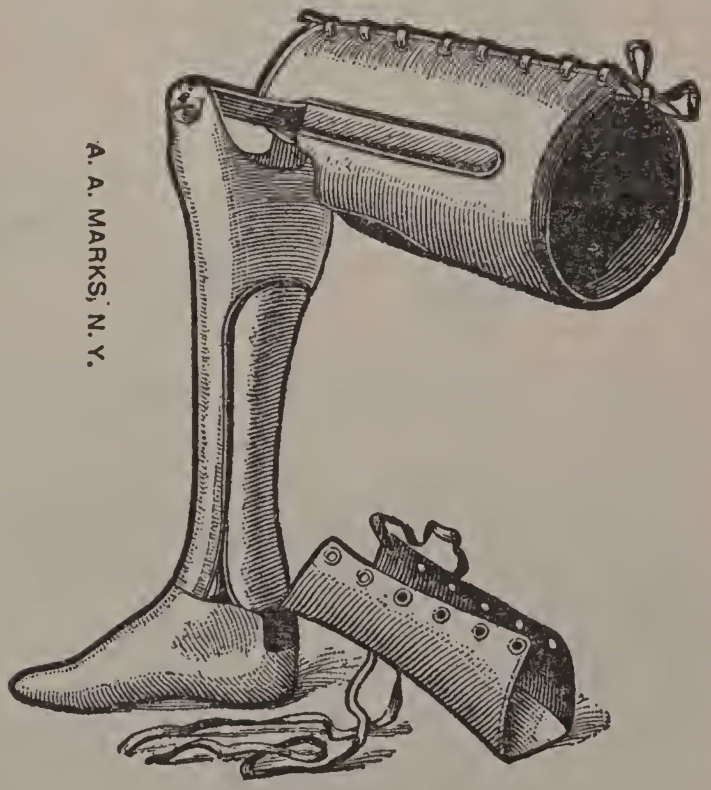


Cut D 19.

Cut D 20.



Cut D 21.



Cut D 22.

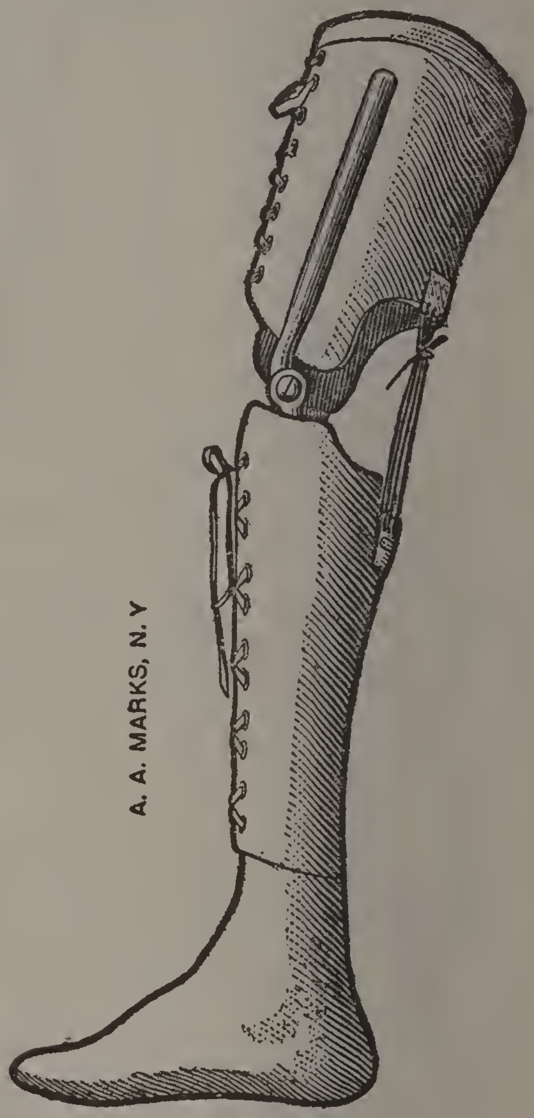
laced. The lower section is made of wood or aluminum, as the conditions of the stump demand. The rubber foot is attached in the usual way, and the leather sheath passes from the rear to the

front, holding the stump in place. The weight of the wearer is supported by side joints connecting the thigh parts with the lower portions.

Cuts D 23 and D 24 illustrate the front and side views of a leg constructed in a similar manner. It is fitted to receive the leg and stump from the front instead of the rear; it contains no important advantage in construction, but is preferred by some persons.

Side joints and thigh supports are essential when stumps cannot

Cut D 23.



Cut D 24.

be supported on the sloping surfaces just below the knees, and when they are liable to become sensitive and irritable on account of impaired vitality.

Peg Legs.—Ankle-joint stumps should never use peg legs except when they need disciplining or shrinking. Some stumps with extremely sensitive ends, on which pressure cannot be immediately applied, give promise of improvement in course of time. There are also stumps that are œdematous—made up with soft, flaccid tissue which will pass away in a brief period. In such cases, an inexpensive peg leg can be used to advantage. One may stump about on a peg leg applied to a stump reaching to the ankle joint, much the same as one who uses a peg leg on an upper amputation, but, having no foot, its functions are limited to that of a support.

CHAPTER V

BELOW-KNEE AMPUTATIONS

Long Tibial Stumps.—An amputation at any point above the ankle and below the knee produces a tibial stump, so termed by the surgical profession, because the tibia or shin bone has partly been saved.

Enlarged Non-End-Bearing.—Cut E 1 illustrates a stump reaching close to the ankle joint. The extremity, as is usual in long stumps, is poorly protected and incapable of bearing pressure, and,

Cut E 1.

Cut E 2.

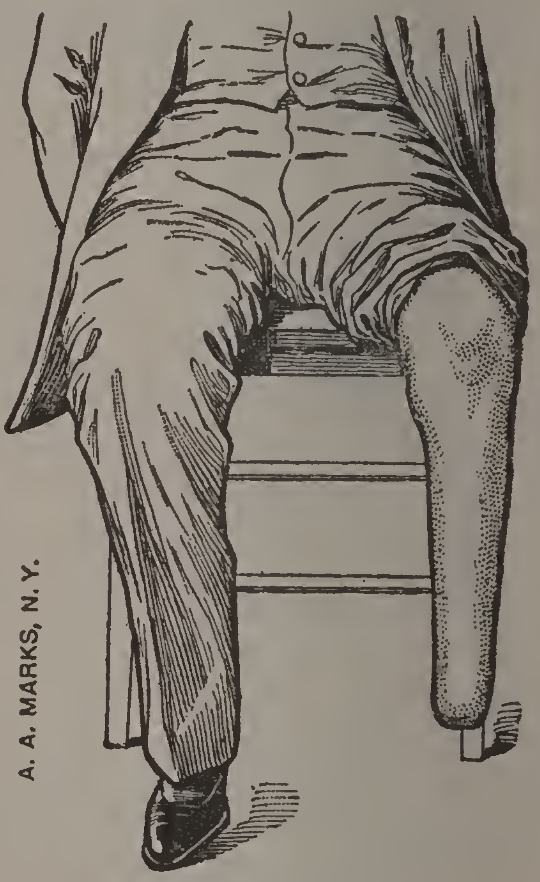
on account of a slight enlargment at the end, an artificial leg must be made so that the stump can be placed in the socket from the front or rear instead of being inserted at the top. Cut E 2 represents an artificial leg especially adapted to stumps of this description; it is shown applied and the wearer seated. It has a socket that incases the rear half of the stump, with a front of leather that can be laced. The rubber foot with spring mattress is constructed as described in Chapter II, and at the top of the socket are steel joints connecting the thigh supporter. The fitting of the leg avoids any weight or pressure on the extremity of the stump or near the end, and no pressure is applied at any point below the junction of the middle and lower thirds. Above this it is graduated

to the knee, where the greatest amount of pressure is applied, the interior sloping surface below the knee carrying most of the weight. The anterior prominences of the shin bone and the exterior prominence of the fibula are given ample room, so that no contact is applied; the interior sloping surfaces below the knee carry most of thė weight, the supporter above the knee carrying its share.

No Pressure at the Popliteal Space.—It is most important to avoid pressure at the back of the knee in long stumps. The popliteal space is the vascular area of the leg, and any undue pressure will interfere with the circulation and impoverish or strangulate the end of the stump.

The absence of ankle articulation in a leg for a long tibial stump affords an opportunity to give ample space for the end without

Cut E 3.



Cut E 4.

visibly increasing the external dimensions of the ankle. The rubber foot with spring mattress and yielding heel and toe provides every requisite for easy, lifelike, and noiseless walking without complicated connections. The absence of such connecting parts avoids the necessity of making the leg an inch or two longer than the natural one as is often necessary to obtain space for ankle mechanism used in other systems.

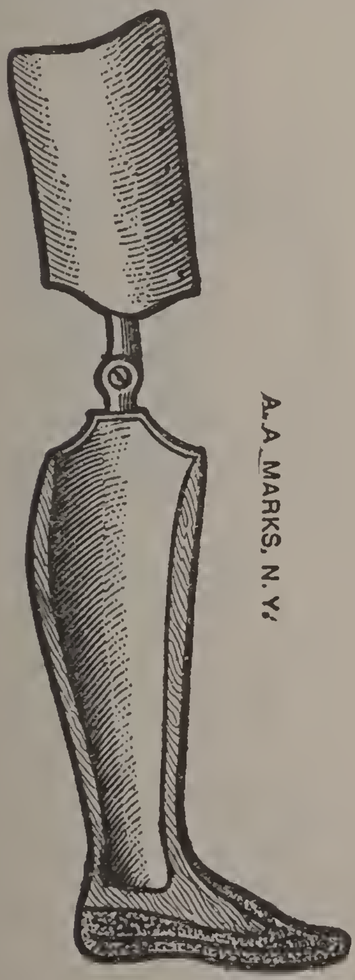
Artificial legs with wooden articulating feet for stumps that reach to any point in the lower third of the leg are impracticable. The ends of long tibial stumps are sensitive, easily irritated, and poorly nourished, and the slightest contact will cause abrasion, frequently necessitating reamputations,.

Tapering Stumps.—Cuts E 3, E 4, E 5, and E 6 illustrate long tibial stumps. Legs for such amputations must be constructed so

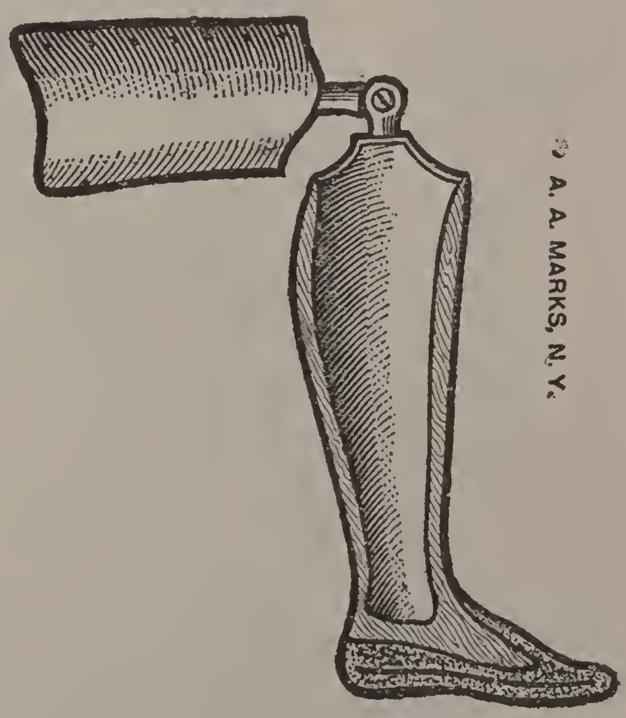
Cut E 5.

Cut E 6.

there will be ample room for the extremities. In other words, the ends are suspended in space. As these stumps are tapering to the



Cut E 7.



Cut E 8.

ends they can be inserted from the tops of the sockets. The socket is hollowed out near the bottom of the heel and an abundance of

room provided, allowing a wholesome circulation of air; the exterior diameters of the leg are not large enough to be conspicuous. The

Cut E 9.

Cut E 10.

leg socket and foot core are connected by an aluminum sheath riveted to each part in the most secure way.

Cut E 11.

Cut E 12.

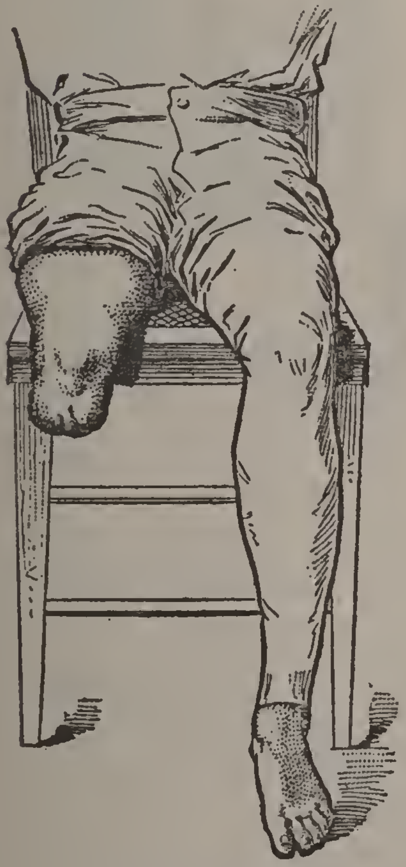
The rubber foot is attached to the core and the leg is finished so the exudations from the extremity of the stump cannot possibly impair the strength of the connected parts.

Cuts E 7 and E 8 show sectional views of a leg for a long tibial stump; the foot and leg parts are so secured that they

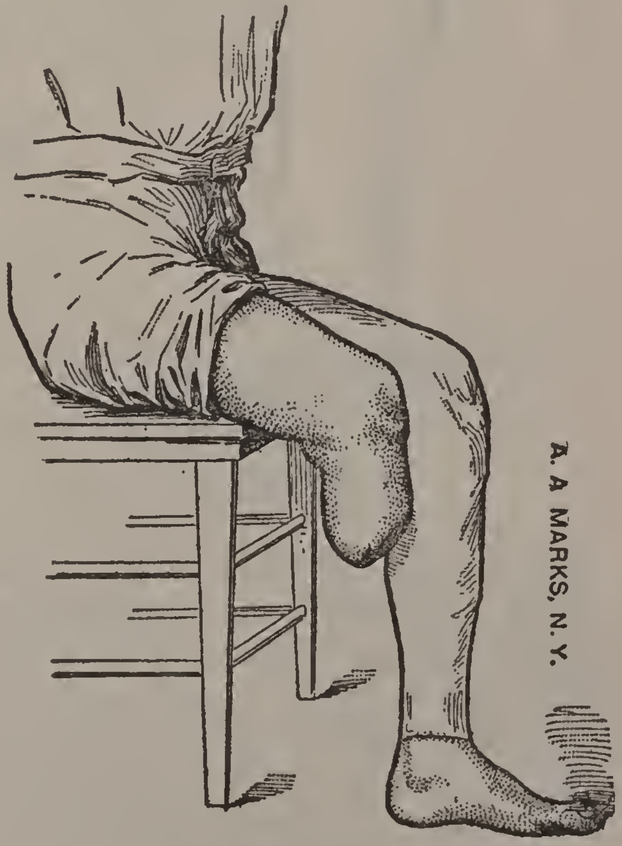
Cut E 13.

Cut E 14.

are practically one. This method of construction admits of



Cut E 15.



Cut E 16.

excavating the socket well into the foot so as to provide ample air space. Substantial legs for such stumps cannot be made

with ankle articulations, for cords, springs and bolts require space needed by the stumps. As metal becomes corroded by the exudations of the stumps, wood is the only material which will withstand these destructive agencies.

Ordinary and Short Tibial Stumps.—No difficulties attend the fitting of an artificial leg to a tibial stump reaching to any point

Cut E 17.

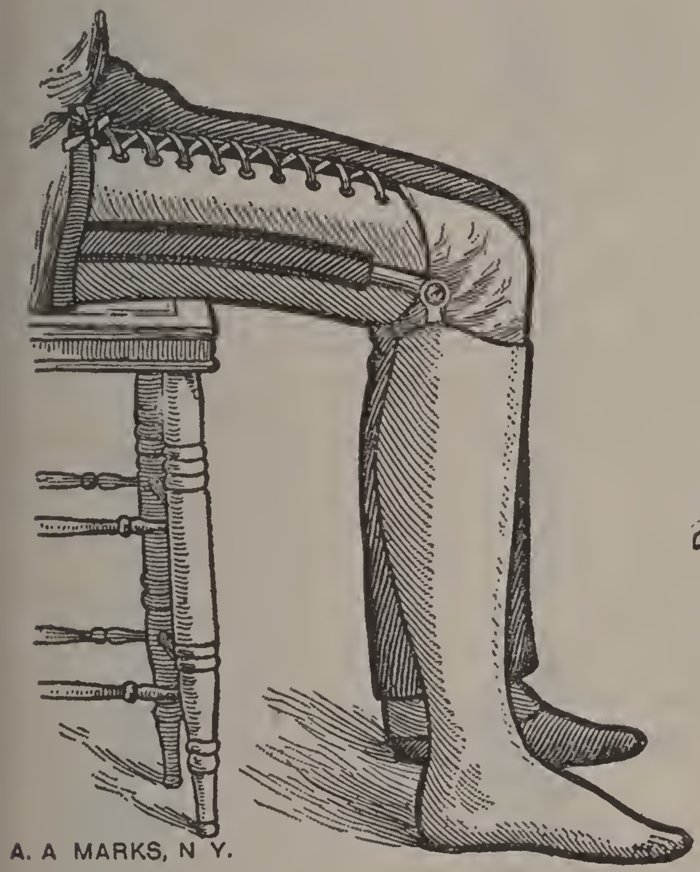
Cut E 18.

between the junction of the middle and lower thirds and the knee, when the knee joint is mobile to not less than two-thirds of the normal range. Cuts E 9 to E 16 are typical below-knee stumps of a variety of lengths and conditions relative to flaps, cicatrices, etc. The location of the cicatrices and the character of the flaps have little importance in non-end-bearing stumps.

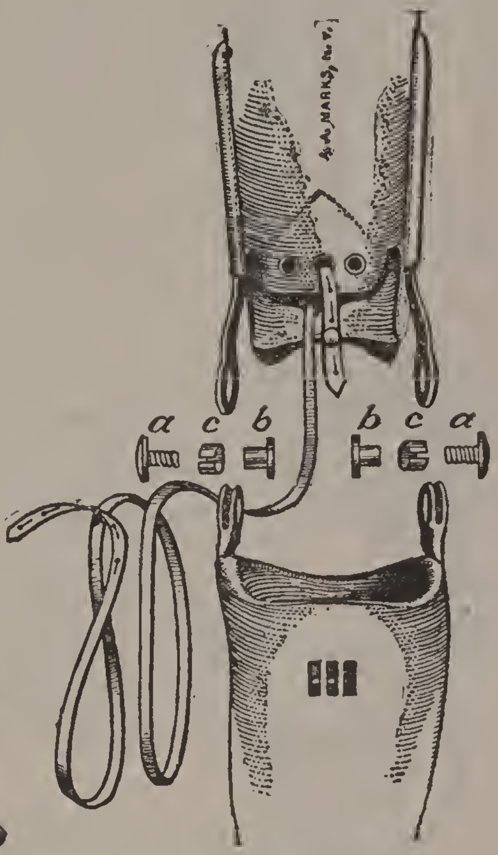
Artificial Leg for Tibial Stump.—A leg suitable for a stump of two inches or more in length, with the knee articulating through a range of 90 degrees or more, is shown in Cut E 17. Cut E 18 shows it applied with the wearer standing. Cut E 19 shows it with the wearer seated. The action of the knee joint is clearly presented.

Construction.—The leg consists of four parts: the foot, the leg, which fills the space between the foot and the knee; the knee joints, and the thigh piece or that part that incases the natural thigh. As the foot has been explained in Chapter II it now remains to describe in detail the other parts.

Socket.—The socket that receives the stump is made from willow or basswood, which is excavated to accommodate the stump. Bearings are permitted at places of toleration. No pressure whatever is put on the vascular parts of the stump or on sensitive or prominent bones. The end of the stump is usually required to hang



Cut E 19.



Cut E 20.

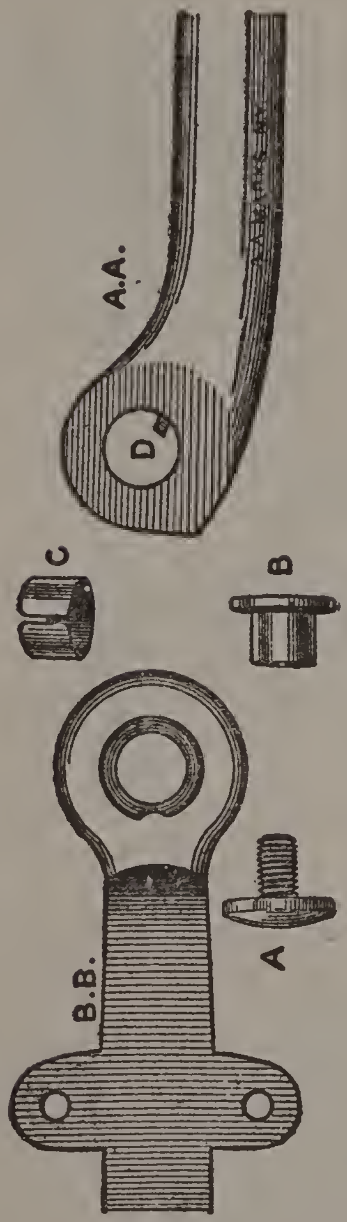
free in space. The exterior of the leg is shaped to as near the natural form as the stump will admit. It is strongly banded and covered. The surface is enameled with a waterproof preparation having a soft flesh tint. Knee joints are of the ginglymoid pattern, and as recently improved have very durable wearing surfaces. The thigh piece is made of substantial leather shaped to the contours of the thigh.

Knee Connection.—Cut E 20 represents the upper section of the leg and the lower section of the thigh piece, with the knee joints disconnected at their articulations; *aa* are the screws that hold the bolts *bb* in place; *cc* are the bushings that work on the bolts and receive the wear; a lacing is used to regulate the action of the knee. The mechanical parts of the knee joints are completely illustrated in Cut E 21.

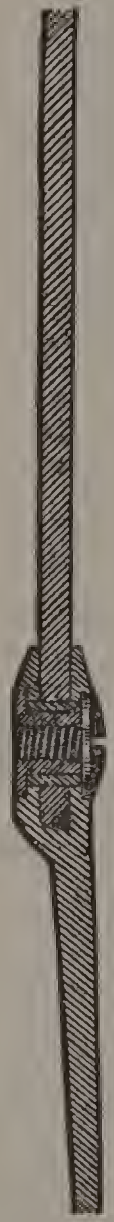
Steel Joints.—Side joints, sometimes called hinge or ginglymoid joints, are used in legs for amputations below the knees. They are more durable and substantial when one of the parts is placed

between the lips of the other and the two connected with bolts and screws.

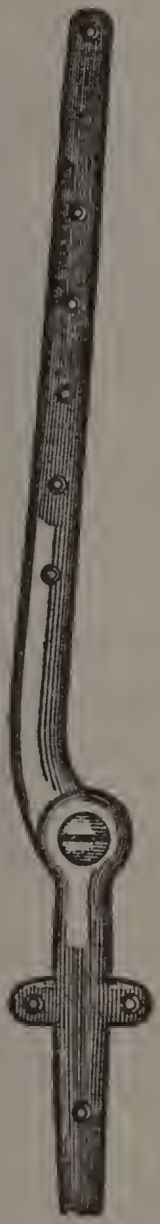
It is unmechanical and not lasting to place one section of a joint by the side of the other, holding them together by a screw, as is done by some manufacturers. Such joints wear irregularly sidewise and have a wabbling motion after limited service. This would not occur if the lateral strains on the upper sections could be kept the same at all times; but lateral pressure, causing unequal wear at the bearings, is brought about by contracting the thigh by lacing, in order to compress an emaciated thigh or distending it to



Cut E 21.



Cut E 22.



Cut E 23.

accommodate an enlarged one. These difficulties are only avoided by having one of the elements of the joints work between the lips of the other.

The greatest wear on any joint is on the bolt that holds the parts together, and as the attrition is the greatest when the wearer's weight is directly over the knee and becomes less as the knee is flexed, the bolt must necessarily wear irregularly. As the wearing surface on the bolt was formerly limited to the thickness of the section that worked on it, the wear was necessarily very rapid.

The object of the improved joint is to increase the wearing surface as much as possible and to make the wearing parts independent and removable. They can then be highly tempered and the non-wearing parts left untempered, so that the supporting parts will not become friable.

The wearing surfaces are increased more than double. They cover the entire surface of the bolt, and the inferior surfaces of the holes in the lips of the lower part. Cut E 21 shows the mechanism very clearly. AA is the upper part; BB the lower part; C is a long bushing which passes through the two lips of the lower part and the one of the upper; the lug D holds the bushing immovably fixed to the upper part. The bolt B passes through the long bushing and becomes immovably fixed to the lower part by means of a stop pin, which is fastened to the hub of the lower part, and fits a recess made in the head of the bolt. The screw A holds the bolt in place and clamps the joint.

A glance at the section, Cut E 22, will show how these parts work together. Every movement of the joint causes the long bushing to revolve about the surface of the bolt and in the lips of the lower part. This mechanism prevents any wear from taking place on either the upper or lower parts, and distributes what does take place over the entire area of the bolt. The bushing and bolt are made very hard, and can be removed and replaced with new ones at any time that may be desirable. Cut E 23 shows a side view of the entire joints and ready to be attached to the leg.

Ball-bearing Joints.—It has always been a mooted question as to the advantage of ball bearings in artificial limb joints. We are not prepared to say that they are better than removable bushings. We make both and the client can have either at no advance in price of limb.

Our method is to use steel balls of large diameters; these travel in a race on one face of the upper joint, held in place by a bolt with race under its head. This bolt is held immovable by a set screw.

Thigh Part.—The thigh part of the leg is made of durable oak-tanned russet leather, formed to the shape of the thigh, and suitably lined inside. There are several methods by which it is made to compress the thigh; buckles and straps are sometimes used; metallic clamps are occasionally preferred; but the greatest number of limb-wearers find the lacing method the most satisfactory, as it permits uniform adjustments and is neat and durable.

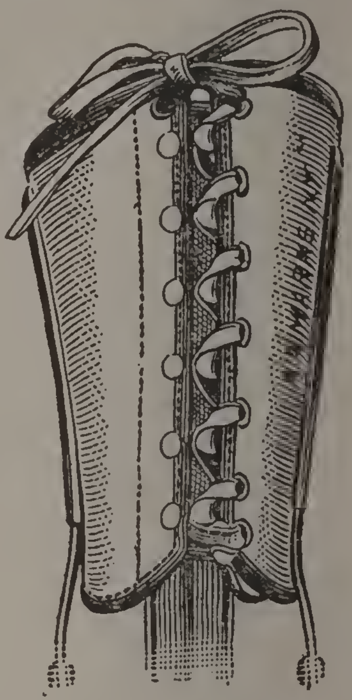
Lacing Methods.—Cut E 24 shows the double-eyelet method. A row of eyelets is placed on each front edge, and a strong buckskin lacing passed through them. This method has been in vogue for many years and is still preferred by many wearers.

Cut E 25 shows the lacing system more generally used at the present time. A row of hooks is placed on one edge and a row of eyelets on the other. On removing the leg the loops of the lacing are simply slipped off the hooks, the string remaining in the eyelet holes. When the leg is put on, the loops are put over the hooks and the cord is tightly drawn. Some wearers wish hooks on each edge,

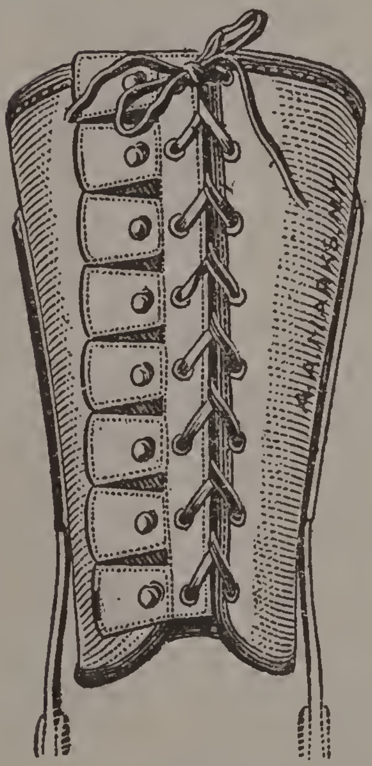
the same as on shoes. When this is wanted it should be specified in the order.

Cut E 26 shows a device for rapid application. A row of studs is placed on one edge of the thigh piece, and a row of eyelets on the other; a separate piece of leather has also a row of eyelets and a

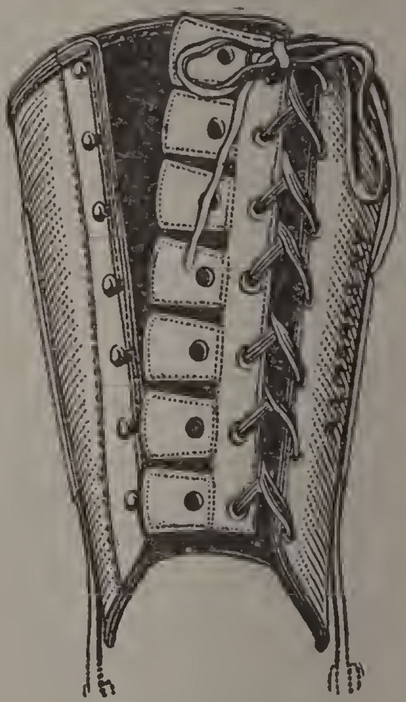
Cut E 24.



Cut E 25.



Cut E 26.



Cut E 27.

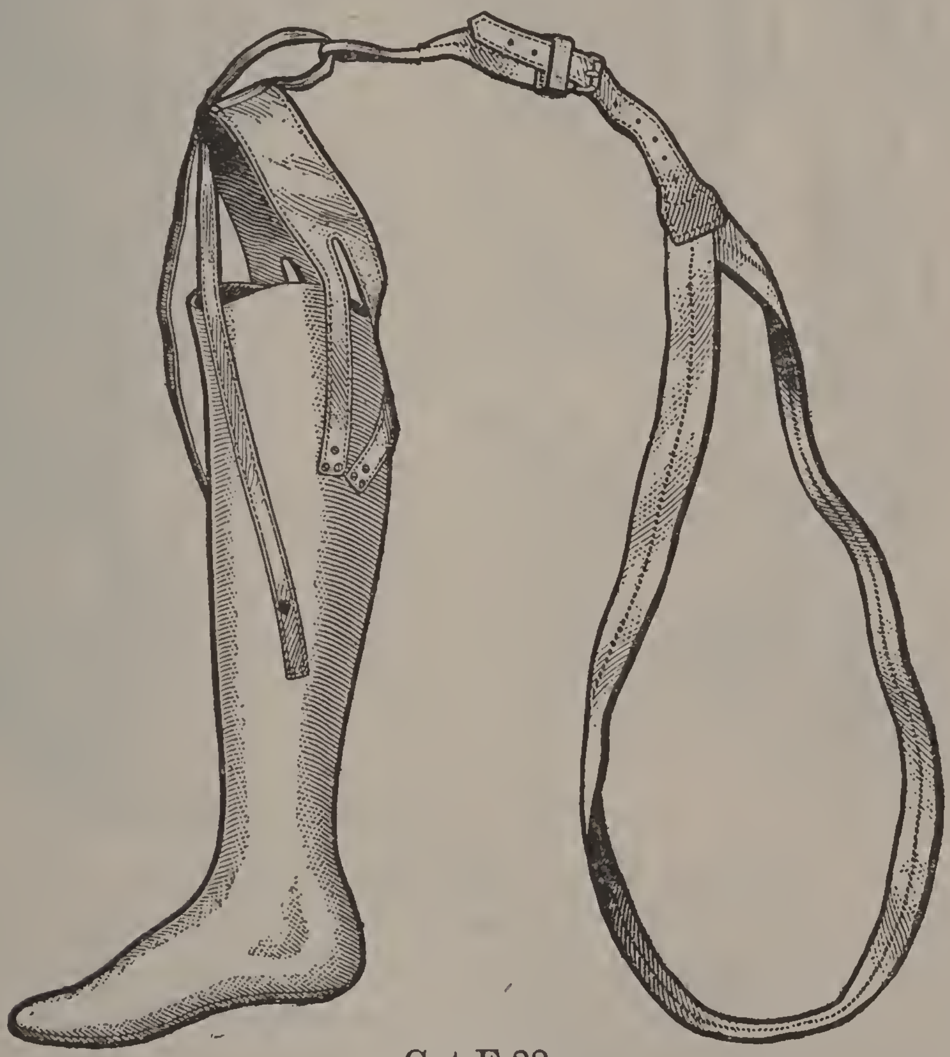
row of studs. This is laced to one side of the thigh piece and buttoned to the other; the lacing can be adjusted once for all. On removing the leg one side is unbuttoned, and the other remains laced, as shown in Cut E 27.

Check Strap.—The lacing at the back of the knee checks the knee action and is regulated by the wearer. It is a very strong leather thong, passing from the thigh piece to the leg part, as in Cut E 20. The more the thong is tightened the less becomes the

motion in the knee, and the more weight will be placed on the ball of the foot and less at the heel.

The stump, in all cases, is inserted into the leg socket; the thigh piece is drawn around the thigh and laced tight enough to hold the leg firmly in place. The stump enters the socket comfortably. Bearings are only admitted about the sloping part immediately below the knee; the anterior surface of the tibia is always accommodated by a channel; the bony prominence of the fibula is provided for by a cavity; and the end of the stump hangs free in space, receiving no pressure whatever, either on the sides or at the end, except when conditions will permit.

Sensitive Stumps.—In cases of extreme sensitiveness the weight can be carried entirely above the knee, and the stump is only



Cut E 28.

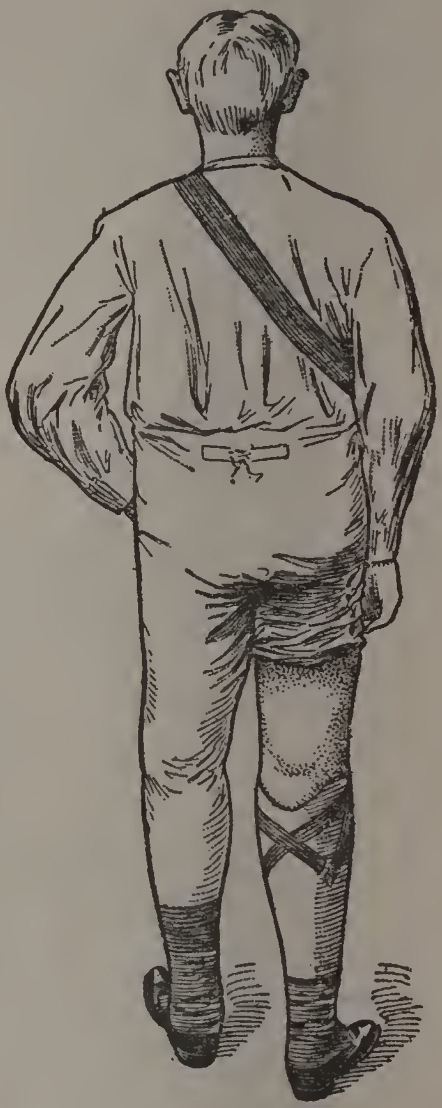
permitted to perform the function of moving the lower leg forward and backward.

Non-End-Bearing and End-Bearing.—Weight can rarely be applied to the end of a tibial stump, and only when the end is protected by bone flap or periosteal flap and well covered with muscle tissue. When such favorable conditions exist an end-bearing pad is placed in the socket of the leg, the thickness of which is adjustable, so as to increase or decrease the amount of pressure on the extremity. The wearer, when dressed either with or without the end-bearing pad, is able to walk, run, sit, or lie down. Every posture will have the semblance of nature, every movement will be

made with surprising naturalness. The loss of the natural leg is absolutely concealed, and the substitution by the artificial restores the wearer to his usefulness.

THIGHLESS LEGS.—Artificial legs for tibial stumps are sometimes made without knee joints and thigh pieces, dependence being

Cut E 29.


Cut E 30.

placed upon the socket when supporting the weight of the wearer, and resisting such lateral strains as may occasionally be brought upon the leg. Such a leg is shown in Cut E 28. From the knee down its construction is much the same as leg E 17. The socket is made of wood excavated to receive the stump properly. The foot is of sponge rubber with spring mattress, and the leg is covered substantially and finished in flesh-colored enamel. Straps attached to the leg in the region of the calf are made to pass around the thigh immediately above the knee cap. If these do not hold the leg firmly in place auxiliary straps are attached, to pass over one or both shoulders.

Some manufacturers advocate the use of thighless legs whether the stumps are long or short, and pay little attention to the character of the extremities. They attach more importance to the absence of thigh constriction than they do to the danger of abrasions on the stump or injury to the extremity.

While it is true that there are many cases in which thighless legs

are applied and worn with evident satisfaction, it must be clear that the absence of a thigh supporter entails a sacrifice of efficiency and protection. Metal knee joints and thigh supporters perform the very important functions of protecting stumps, avoiding side strains, injuries from concussions, and the tearing of cicatrices. Cut E 29 shows a thighless leg applied, the wearer standing; Cut E 30 the rear view of the same, Cut E 31 the side view, and Cut E

Cut E 31.

Cut E 32.

32 the wearer seated. These cuts show the operations of the leg and the action of the suspenders.

Dangers.—When the wearer is standing with his weight on an artificial leg of the thighless type the stump has to carry all his weight. This usually comes upon the sloping parts immediately below the knee. If the wearer makes a misstep and recovers himself by his artificial leg the stump will receive a strain; if he carries a heavy weight his stump must resist a force that tends to push it further into the socket; and unless the sides of the stump are sufficiently sloping to oppose this there will be danger of injury to the flap and cicatrix.

One of the chief objections to the thighless leg is the difficulty that arises when the stump changes in size, as it so often does. If the stump becomes emaciated the socket of the artificial leg must be filled up to compensate for the loss of flesh, and if the emacia-

tion is not uniform there will be considerable difficulty in padding the inner surfaces of the socket so as to avoid pressure on delicate parts.

One should never experiment with the thighless leg unless the stump has been accustomed to wearing an artificial leg for a considerable length of time, and has become so thoroughly disciplined that further changes are not likely to occur. Those who insist on wearing thighless artificial legs, who have worn them from choice, and who have their stumps sufficiently disciplined will be accommodated in their wishes.

Slip Sockets versus Wood Sockets.—Rival manufacturers have said and published much about the slip or sliding socket and considerable curiosity has been aroused among limb-wearers as to the merits of the idea. As the slip socket applies almost exclusively to artificial legs for tibial stumps, the subject may be introduced and discussed at this time.

We have given the matter much thought and subjected it to a most rigid investigation. We have, moreover, submitted the scheme to many tests and have conferred with several hundred persons who had worn slip sockets. Our investigations were planned to determine whether the scheme had sufficient merit to warrant us in adapting it to our work.

We have long been aware that a well-fitting socket of wood or any smooth hard material will never chafe the stump, even if the stump is permitted to move in it. On the other hand we have known that any socket made of a yielding material like leather will, from the constant pressure and heat of the stump, change in form and cease to be comfortable. Perspiration and other exudations from the stump have deteriorating effect on any material that permits absorption. All exudations from the stump becomes putrid in a very short time and cause offensive odors and bring effete matter in contact with the skin. This almost invariably infects the stump and causes unhealthy conditions. A hard highly polished surface is more pleasant for the stump than any form of soft yielding cushions.

The slip-socket idea is somewhat antiquated. In 1866 the United States Patent Office issued letters patent No. 55,645 to Daniel Gilson, covering the principle of the slip socket, consisting of a leather socket molded on a cast of the stump, then placed inside the artificial leg, and held in place by springs. Its object was to obviate the movement of the stump in the socket and to localize all the motion between the stump socket and the socket of the artificial leg. It was very soon found that the stump socket, being tightly held to the stump at all times, constricted the blood vessels and caused much trouble. The inventor, being conscientious, abandoned the manufacture of legs on that plan.

Quite recently, however, the slip-socket feature has been revived, and some insignificant modifications made on the original Gilson model, mainly in the mode of suspending the inner or slip socket. The idea has been extensively advertised and a considerable num-

ber put in use. We have records of many of these cases, and we feel it a duty to the maimed community to disclose the effects a slip socket has had on many stumps.

It must be remembered that in order to carry out the principle of the slip or sliding socket the stump must remain under constant pressure, great enough to avoid any motion or friction between the stump and the socket. All the slipping and sliding due to the intermittent application of weight, as in walking, takes place between the slip socket and the socket of the artificial leg. Few stumps can tolerate this constant pressure without the blood vessels becoming strangulated; we therefore do all we can to dissuade clients from risking such a dangerous experiment.

Slipping of the Stump Desirable.—There is nothing so pleasant to a wearer of an artificial limb, no matter what kind of a leg he is wearing, as to be able to lift his stump from its bearings and give it a chance to rest and recover, exactly as one does when standing on natural legs. He throws his weight on one leg for a while and then on the other, and in this way both legs in their turn become rested. Every wearer of a wood-socket limb invariably does this. It is a source of comfort and relief; but it cannot be done with the slip socket, which clings to the stump like a leech.

The socket that is made to fit the stump so that pressure will be uniformly distributed over all its parts, is neither scientific nor tolerable. Every stump has parts that will bear pressure and parts that will not stand any at all. Parts where blood vessels and nerves are clustered, where the bones are close to the surface and poorly protected by tissue, must be prevented from impact. A flexible socket has a tendency to assume the shape of the stump and distribute the pressure uniformly, bringing as much on the forbidden parts as elsewhere. Therefore the flexible socket is a dangerous one to wear.

A socket that fits properly will never chafe the stump, no matter how much it may slip, slide, or move in it. This is a fact ascertained by most careful, thoughtful, and conscientious investigation, and cannot be successfully controverted. We know from very ample experience and inquiry that there is no socket so pleasant to wear, so light, so cool, and so healthful for the stump as the wooden one, when properly and scientifically fitted. No material has ever given such permanently good results as wood.

An Instance.—Mr. Frank M. Talbot met with a railroad accident in 1890 which crushed his leg. Amputation was made below the knee, leaving a stump four inches in length. He obtained an artificial leg with wooden socket, which he wore for some time with efficiency. His stump, following the usual course, emaciated, and instead of having the leg refitted he was prevailed upon to order a new leg with a slip socket. He wore the leg for a while, but gradually the end of his stump became congested and painful. He went to his slip-socket leg-maker for relief, but was told that his stump was diseased and nothing but medical or surgical treatment would help him. The stump grew worse; he called in a

physician, who by medication brought it to a healthy condition, but put him on his back for a while. Shortly after he resumed wearing the slip-socket leg, the trouble recurred. He came to New York, and under the impression that his stump was diseased, consulted several prominent surgeons. All agreed that the stump had been strangulated by the artificial leg, and unless the cause was removed the bone would soon become infected and re-amputation would be necessary.

Mr. Talbot called upon us, and on examination we found the end of the stump swollen and as blue as indigo. An abscess was forming. We told him that his trouble was due to pressure upon the blood vessels, and advised him to abandon the slip socket, and wear a wooden one, so fitted that it would not constrict the blood vessels nor permit any of the tender parts of the stump to take pressure. He yielded to our advice, and we made and applied a leg with wooden socket and our patent rubber foot. It was remarkable how quickly his stump recovered. As soon as the pressure was removed from the vascular parts, circulation was restored and the stump became healthy. This was eleven years ago and the stump at this writing is in a healthy condition, without the slightest indication of a recurrence of his trouble. We can cite hundreds of cases similar to this and will gladly furnish additional data to those desirous of investigating further.

Waterproof Legs.—There are some occupations that require limb-wearers to stand in damp and wet places, exposing their artificial legs to moisture, much to their injury. Farmers, miners, builders, woodsmen, raftsmen, trappers, oystermen, fishermen, watchmen, sailors, stablemen, chauffeurs and a thousand others are of this class.

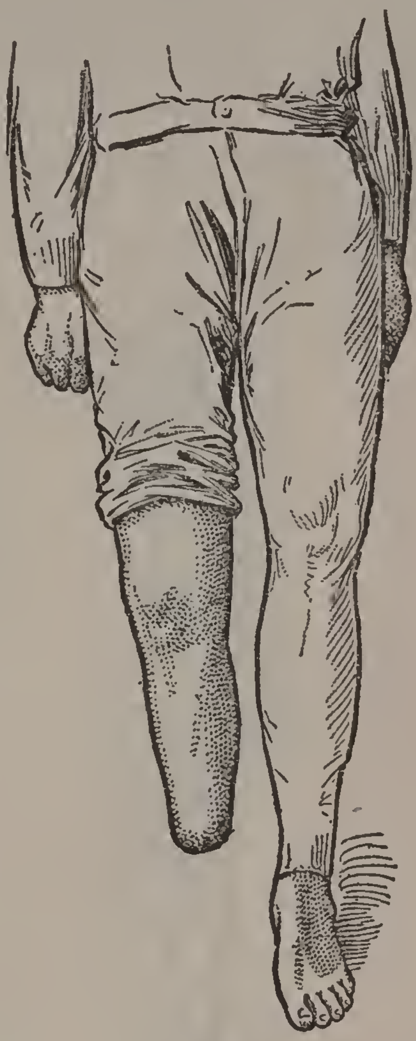
Our method of constructing artificial legs enables us to meet the requirements of these people as they have never been met before. The foot is of sponge rubber with spring mattress, it is permanently secured to the leg and the whole is covered with suitable material coated with a waterproof preparation. This method is secured by Letters-Patent July 9, 1912.

Bathing Legs.—Persons who indulge in aquatic sports can use artificial legs of this kind; with them they can wade, bathe, or swim in salt or fresh water exactly as persons in possession of their natural limbs and without disclosing the fact that their limbs are other than those provided by nature. Cut E 7 is a sectional view on which waterproof legs are constructed. It will be seen that there are no parts that can be affected by moisture. The entire lower leg is capable of withstanding the severest strains and exposure.

Shortened Thigh.—Complicated conditions in tibial amputations frequently present themselves and require specially designed artificial limbs. Cut E 33 illustrates a case in point. The injury to the patient, necessitating the amputation of the leg below the

knee, fractured the thigh and dislocated the hip. The femur became lapped and deflected and its head was permanently displaced. This occasioned a shortening of the thigh of several inches. In the artificial leg the shortening of the thigh was com-

Cut E 33.



Cut E 34.

pensated for by lengthening below the knee. A leg constructed on the plan of E 17 is suitable for cases of this character. Its thigh piece is made to extend well up to the body and take in the gluteal folds and the entire external surface as far as the crest of the ilium, thus giving the necessary support to the fractured part.

Cut E 34 illustrates a case of shortened thigh of the left leg while the right was amputated. It resulted from a railroad accident which crushed the right foot and ankle and fractured the opposite thigh. The right foot was amputated at the junction of the lower and middle thirds. Despite every effort to bring about the correct union of the fractured femur of the left leg, the bones slipped, resulting in a shortening of the thigh by several inches. An artificial leg constructed on the plan of E 17 was applied. The leg from the knee down was as much shorter than the left as the thigh of the left was shorter than the right.

In both these cases the artificial legs necessarily caused a disparity in the lengths of the legs from the knees down, but the differences were not noticeable, even when the wearers were seated,

except when closely scrutinized. In other respects there were no inconveniences experienced.

In ordering an artificial leg every peculiarity of the sound leg as well as the partly amputated one should be brought to the attention of the manufacturer.

The Lateral Adjusting Socket.—Changeable stumps are more frequent than generally known. By changeable stumps we mean those that remain large for a period and then became small and then large again. This characteristic is inherent in some stumps and cannot be controlled by any method of treatment. An artificial leg capable of being endured on a stump of this kind is

Cut E 67.

Cut E 68.

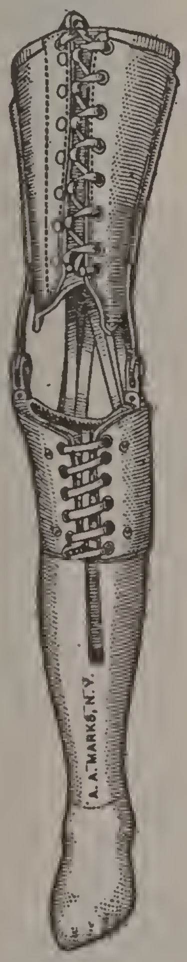
usually made large enough to receive the stump when it is at its largest dimensions, and when at its smallest additional socks are worn, or linings are put in the socket. There is some inconvenience and annoyance incurred in this way of adjusting.

Some manufacturers make sockets of leather, with lacings down the front, or rear, or both and claim that by drawing these lacings up or letting them out, the required adjustment can be made. It is easily seen that this method admits of adjustment from front to back only; the distance from side to side remains the same; the steel side joints, necessarily moving on the same axis, will not admit of any change in that direction. This is opposite to what it should be; if the distance from front to back is lessened there is increased pressure on the shin bone as well as on the blood vessel back of the knee. The shin bone cannot endure

pressure and the blood vessels back of the knee, if constricted for a length of time, will suffer from interference with the circulation, and trouble in the end of the stump will follow.

The Marks lateral adjustable socket admits of the adjustment in the right direction; this is made possible by giving the side joints an additional hinge so that they will move sidewise as well as front and back. With this hinge, and a socket slitted front and back, it is possible to draw the sides of the socket closer together or set them further apart, and still have the centers of motion in the knee joints work on the same axis.

This method of constructing artificial legs with provisions for



Cut E 69.

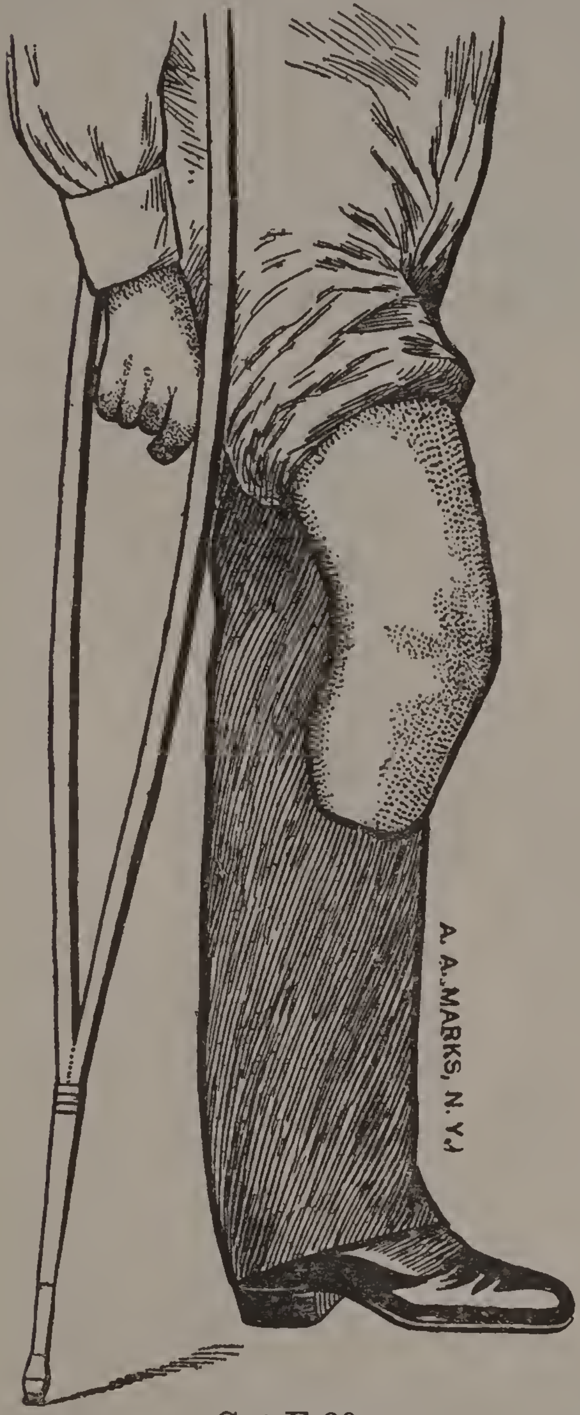
Cut E 70.

lateral adjustment has been applied to changeable stumps since 1909. It has stood this thorough test and proved its efficiency in many cases. Patented July 9, 1912.

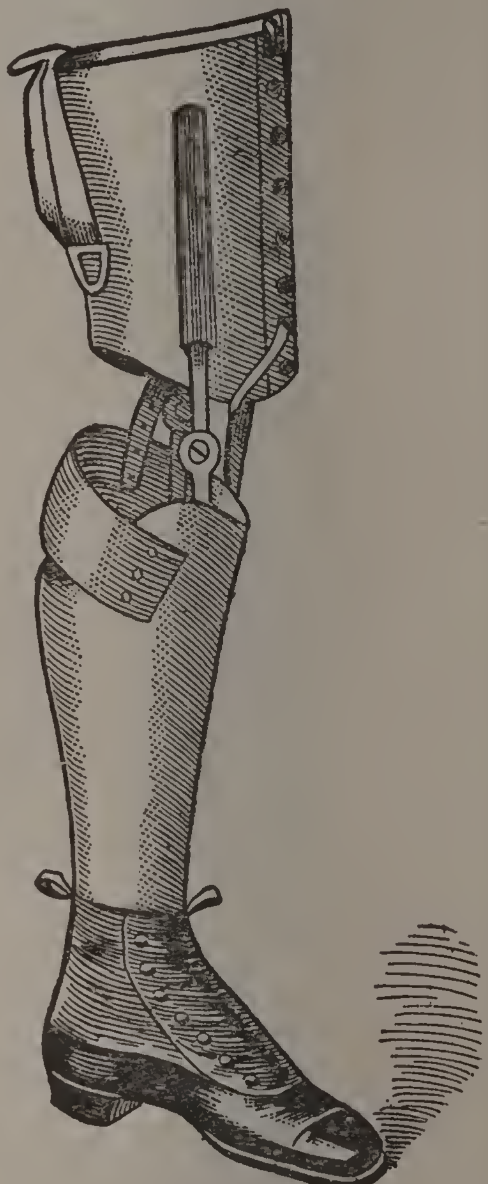
Cuts E 67 and E 68 present front and rear views of a leg with socket wide enough to accommodate a large stump, and cuts E 69 and E 70 present the same leg front and rear views with the socket made smaller by drawing together the sides, thereby accommodating the same stump when it has become smaller.

Contracted Knee Joints.—Another class of leg stumps are those which are sufficiently long to control the knee movements of the artificial leg, but being partly contracted, the extension of the knee is somewhat limited, so that the use of the ordinary type of E 17 leg is impossible, while the contraction is not sufficient to make the knee joint inoperative in controlling the artificial leg.

Knee joints of tibial stumps become contracted either from the results of the injuries that occasioned their amputation, or, more frequently, from neglect in permitting the stumps to remain in semi-flexed positions during the convalescent periods. Cut E 39



Cut E 39.



Cut E 40.

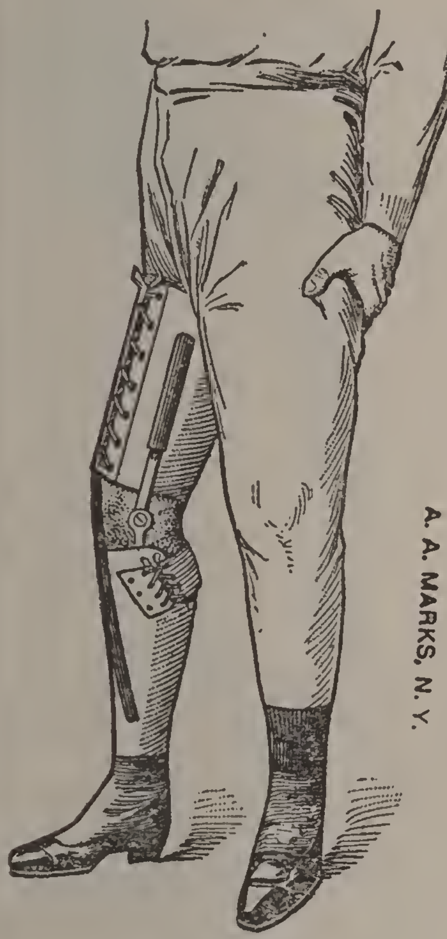
illustrates a partially contracted knee of a tibial stump which is capable of full flexion but of limited extension.

An artificial leg on the plan of E 17 with a slight modification of the socket, as shown in Cut E 40, meets the requirements of the case. By referring to Cut E 41 it will be seen that the stump is received in the socket while in a semi-flexed position. The socket is so made as to bring constant and gentle pressure upon the hamstrings every time a step is taken. The object of this is to induce the breaking up of the contraction and eventually restore full knee motion. The artificial leg is provided with a lacing attachment that passes over the rear part of the stump. As the stump improves in extension this lacing strap is tightened and greater pressure brought upon the stump.

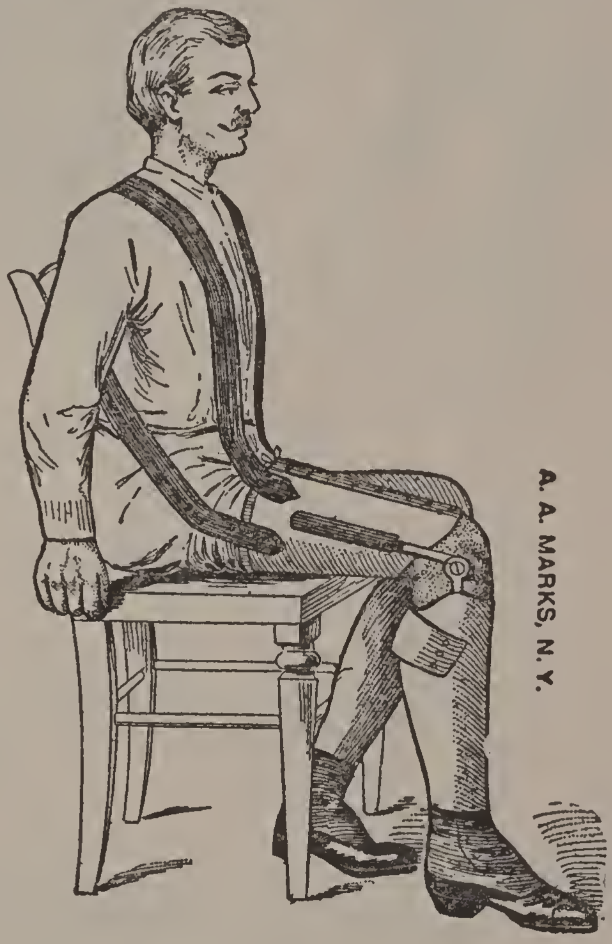
Although a stump may be contracted to a considerable angle a leg of this character can be worn and the wearer enabled to get about in an advantageous way, concealing his loss, walking in a graceful manner, and dispensing with the use of crutches.

We know of no more practical method for breaking up the contraction in the hamstrings than wearing an artificial leg of this type. The wearer is permitted to engage in his usual occupations while the work of restoration of the knee motion progresses. When the knee has become corrected and the stump can be extended to a straight line, the socket on the artificial leg can be removed and the regular socket, similar to that shown in Cut E 17, applied at a very slight expense.

Cut E 41 shows the leg applied to a contracted stump and the wearer walking. Cut E 42 shows it with the wearer seated. The



Cut E 41.



Cut E 42.

contraction of the hamstrings does not interfere with walking, standing, or sitting.

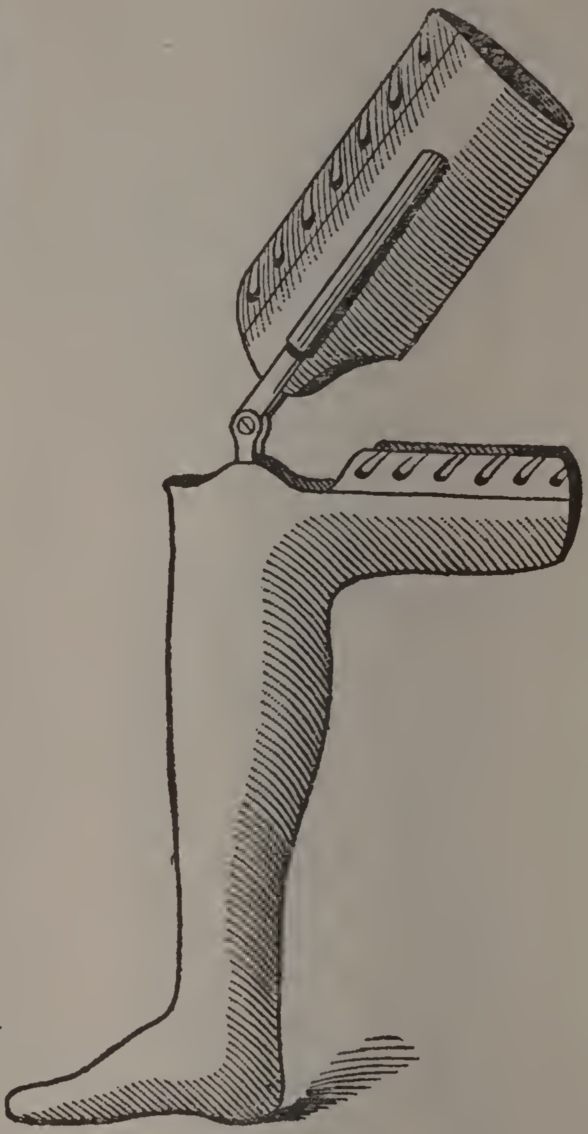
Cut E 43 illustrates a tibial stump with a contraction of the hamstrings considerably greater than in the last case, so great as to prevent the knee from extending beyond a right angle with the thigh. Cut E 44 represents an artificial leg suitable for this case.

A knee-bearing leg might be considered the more suitable, but when the fact is remembered that there is an angular motion in the knee, with the possibility of improvement, it is better to apply a leg that will keep up the action of the knee and bring a constantly increasing tension on the hamstrings. A leg constructed

on the plan of that represented in Cut E 44 is made for this purpose.

Hypertrophied Tibial Stump.—Amputations through the tibia are sometimes necessitated by hypertrophy, with induration of the foot and ankle, as in the case of elephantiasis. Such cases usually

Cut E 43.

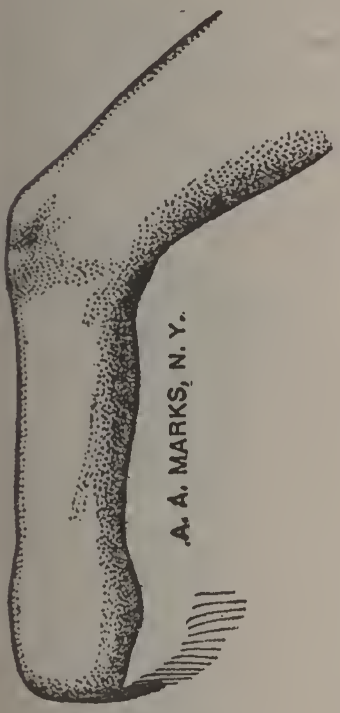


Cut E 44.

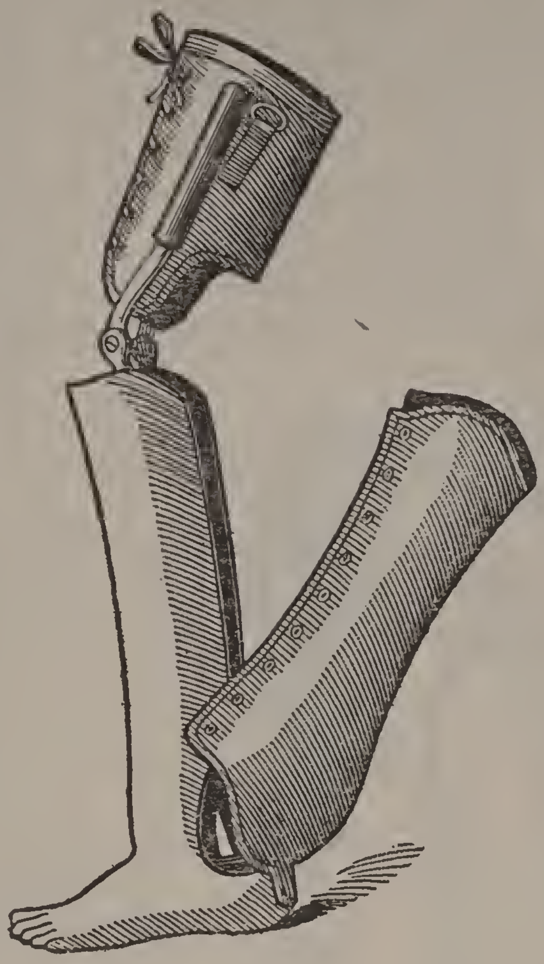
produce stumps that are much larger at their extremities than above, the extremities incapable of bearing pressure, and the sides able to tolerate only limited compression. Cut E 45 shows a stump of this character. It requires an artificial leg constructed upon the plan of E 46, with the rear open so as to receive the stump, the stump and socket are incased by a sheath holding the parts together. Cut E 46 represents a side view of an artificial leg suitable for such cases. Cut E 47 presents the front view with leg applied.

In all the complicated cases previously described, the method of constructing artificial legs with rubber feet and spring mattress is especially advantageous. Great strength is obtained, durability is secured with minimum weight and bulk about the enlarged extremity.

Anchylosed Knee Tibial Stumps Extended.—Some tibial stumps are rigid when extended. That is, they cannot be flexed, owing to anchylosis of the knees resulting from the injuries that

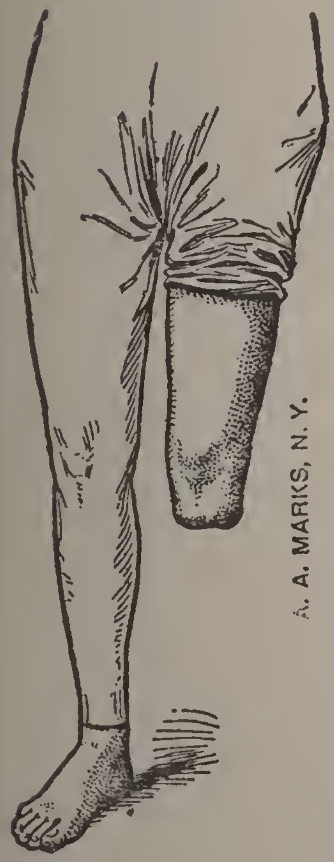


Cut E 45.

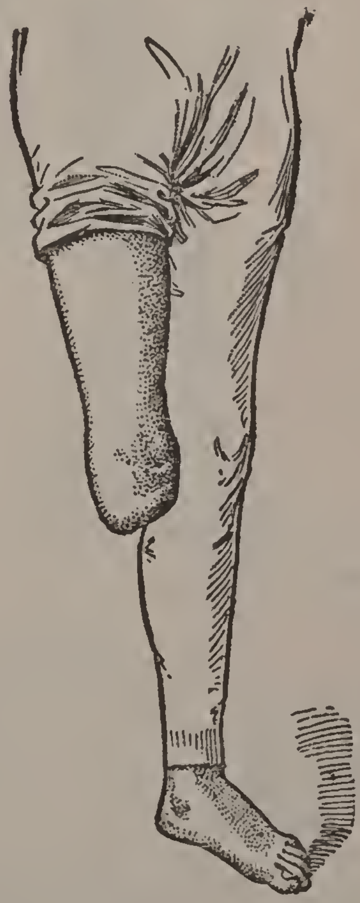


Cut E 46.

Cut E 47.



Cut E 48.

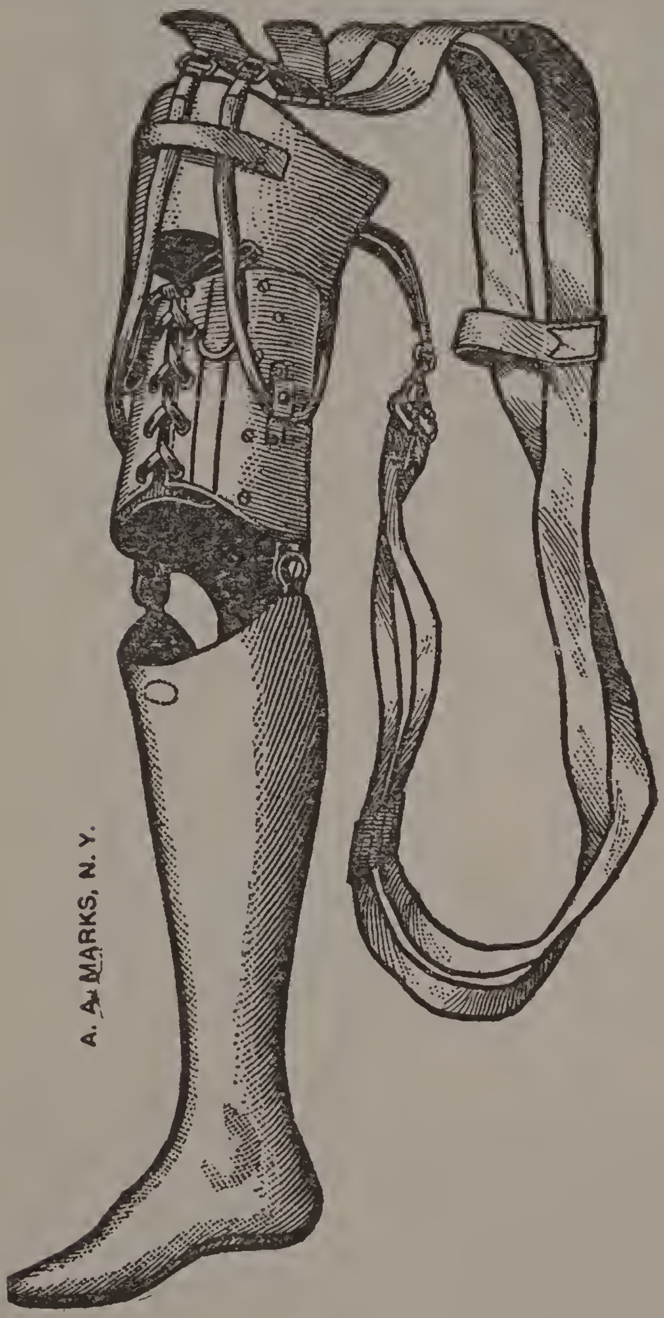


Cut E 49.

caused the amputations, impairment of the knee tendons, calcareous deposits in the articulations, and many other causes. If there is an absence of mobility in the knee and the stump is extended, an

artificial leg must be constructed so that the artificial knee articulation will be independent of the natural knee and operate on the sides of the stump approximately at the points where the natural articulation takes place. Cuts E 48 and E 49 represent tibial stumps extended, with knee joints anchylosed.

It will be observed that in Cut E 48 the sides of the stump and thigh are approximately parallel, or in other words they do not slope sufficiently to offer any sustaining surfaces. An artificial leg



Cut E 50.

Cut E 51.

constructed on the plan of Cut E 50 is intended for a stump of this character.

The top part of the thigh piece is annular and permits the stump and thigh to enter until the gluteal folds, the ischium, and the perineum come in contact with the top border of the socket, where the entire weight is applied, the same as if the amputation had been made in the middle of the thigh. Cut E 49 represents a stump the sides of which are tapering sufficiently to offer some opposition, sustaining in part the weight and lessening the amount

of pressure on the top border of the socket. An artificial leg constructed on the plan of E 51 will meet the requirements of this case. Both of the above artificial legs are made to articulate at the knees.

The legs from the knees down are constructed practically the same as the E 17. The thigh piece is leather and wood; the rear of wood and the front of leather arranged for lacing, so that the required pressure will be brought upon the thigh to hold it in place. Leg E 50 differs from E 51 in the top of the socket, it being annular with continuous border. It is held securely to the body by the lacing front, assisted by suspenders passing over the shoulders.

The knee joints of these legs are of the hinge style as illustrated in Cut E 21. Articulation at the knee is limited by a check cord

Cut E 52.

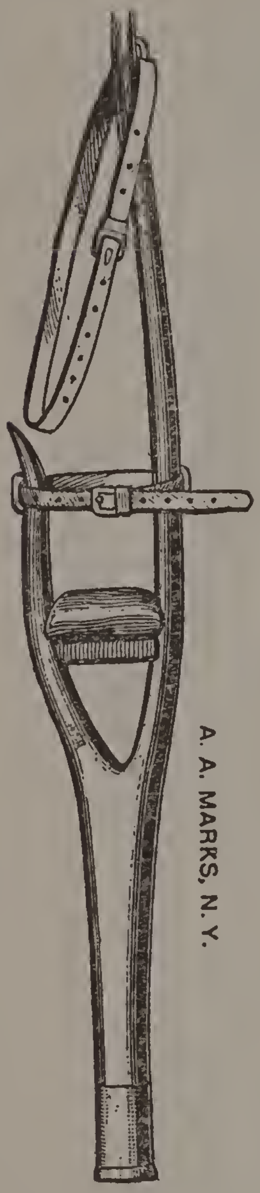
Cut E 53.

connecting the thigh and calf sections. Cut E 52 shows the leg applied, the wearer seated; and Cut E 53 shows it with the wearer standing. It will be seen that the knee articulation approximates very closely the action of the opposite leg and permits the wearer to stand, walk, sit, or kneel.

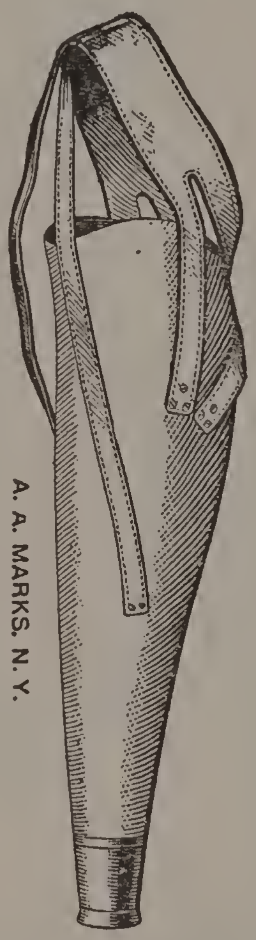
Peg Legs.—Peg legs suitable for tibial stumps are of three kinds. The simplest and least expensive is shown in Cut E 54. It consists of two wooden branches, one running up on the outside of the thigh, well up on the body, the other on the inner side reaching nearly to the crotch.

These branches unite below the point of bearing and continue to the ground, terminating in a rubber tip. A padded shelf is placed between the branches on which the knee rests when in a flexed position. The leg is held in place by leather straps passing around the thigh and body.

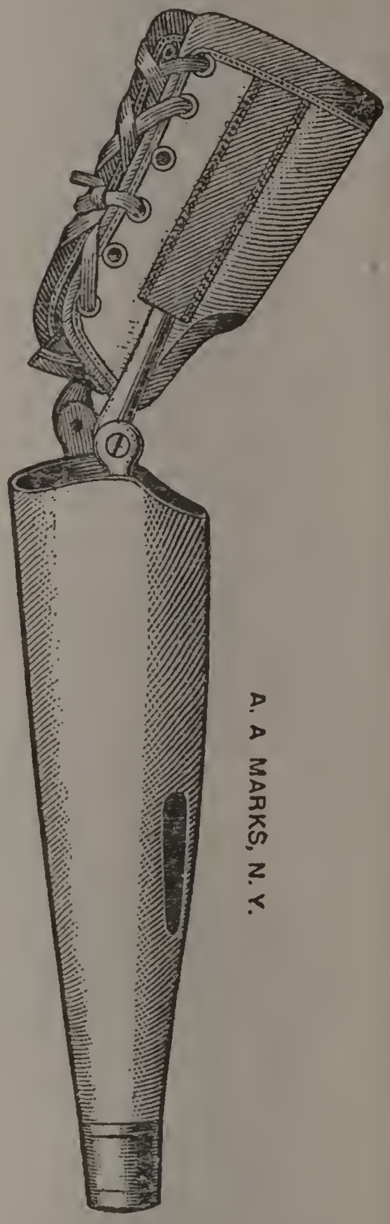
Cut E 55 shows a peg leg without knee joint or thigh support suitable for a tibial stump. The socket is shaped to receive the



Cut E 54.



Cut E 55.



Cut E 56.

stump from the knee down in a comfortable way. The base terminates with a rubber tip, and straps necessary to hold the socket on the leg are connected with the leg and passed around the thigh immediately above the knee cap. When necessary, suspenders are attached to help carry the weight.

Cut E 56 shows a peg leg suitable for a tibial stump constructed practically as E 17, except that there is no rubber foot, a rubber tip taking its place.

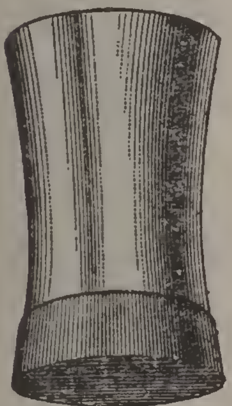
Peg Legs Should Not be Used Permanently.—Peg legs are worn as temporary expedients, for disciplining stumps, or to bridge over an impecunious period. We know persons, however, of ample means who have reached advanced years, who from childhood have

constantly worn peg legs, and doubtless will continue to do so, as long as they live.

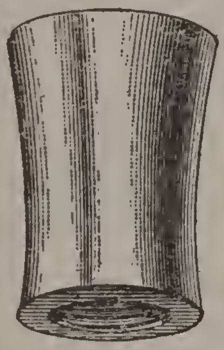
It is quite possible to stump around on peg legs and do much hard work with them. They are immeasurably better than crutches, but they are very far from rendering the services that can be obtained from artificial legs with sponge rubber feet. The foot is an essential factor in helpful easy walking, and a means of opposing strains required in carrying heavy weights, ascending or descending stairs or elevations, and in walking long distances.

We disparage the use of peg legs, as we are keenly alive to the fact that they are inadequate to meet the demands that must be put upon them. Any form of peg leg that will keep the knee joint in a flexed position is liable to weaken the tendons of the knee, impair the knee movement, and limit its range of motion. They should, therefore, be used only as expedients.

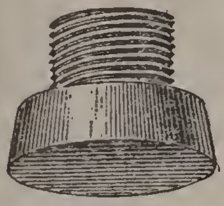
Ferrules for Peg Legs.—Cut E 57 represents an aluminum peg-leg ferrule and rubber tip. Cut E 58 represents the aluminum ferrule separate, and Cut E 59 represents a pure gum rubber tip



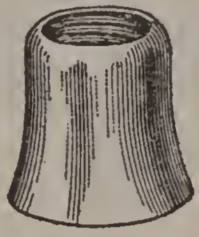
Cut E 57.



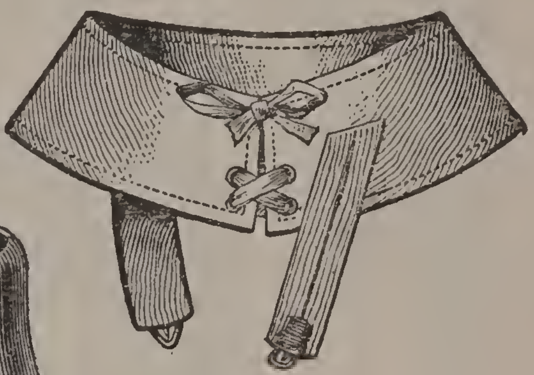
Cut E 58.



Cut E 59.



Cut E 58½.



Cut E 61.

separate, which screws into the ferrule. Cuts represent one-quarter size. The ferrule is permanently fastened to the peg leg, and the rubber tip screws into it.

Rubber Tip.—When the rubber tip wears down so that the metal ferrule touches the ground, it should be removed and a new one put in. The base of the rubber tip is 2 1-2 inches in diameter and the threaded shank is 1 1-2 inches in diameter.

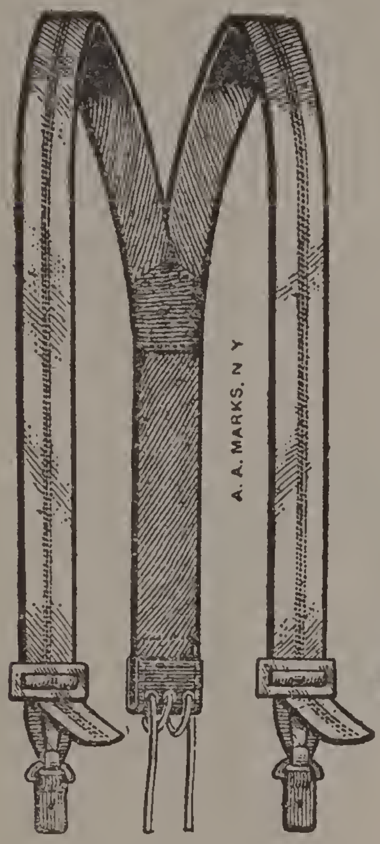
Suspenders.—Suspenders for artificial legs for tibial stumps are of many kinds. Most persons with long and healthy stumps do not use suspenders at all, and a very small number retain them after they have become accustomed to their artificial legs.

As an aid for the beginner, however, we deem it advisable to put suspenders on every leg made for tibial amputation, whether the stump is long or short.

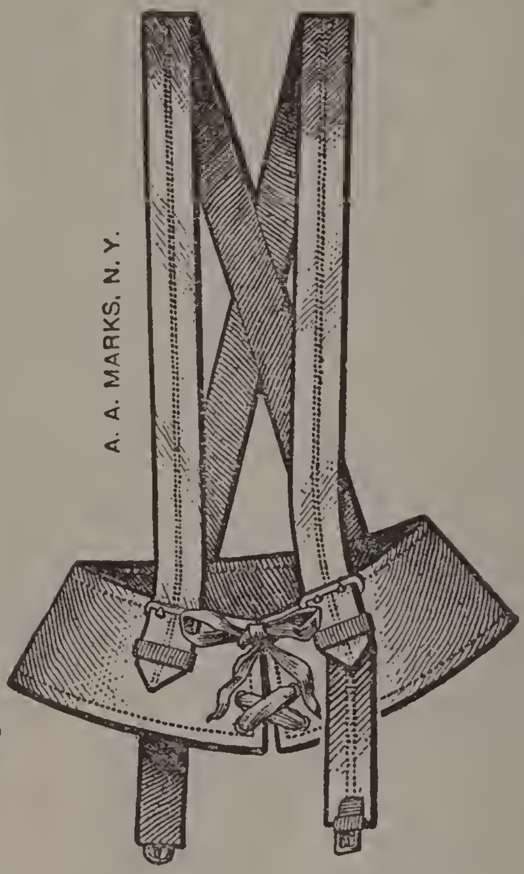
Cut E 60 shows a double suspender for a tibial stump leg. It

consists of two-inch elastic webbing connected with the back of the thigh piece and running well up to the shoulder, where two non-elastic straps, each 1 1-2 inches wide, are attached which branch so as to pass over the shoulder. They are connected with the upper part of the thigh piece in front, and adjusted by clamp buckles with snaps.

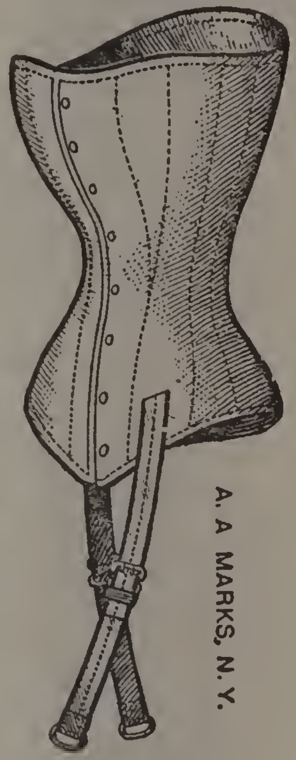
Cut E 61 presents a simple yoke suspender preferred by women. It is made to fit the body immediately above and upon the hips.



Cut E 60.



Cut E 62.



Cut E 63.

It is seldom necessary to use shoulder straps. Straps running down from the belt connected with the upper part of the thigh piece are usually ample.

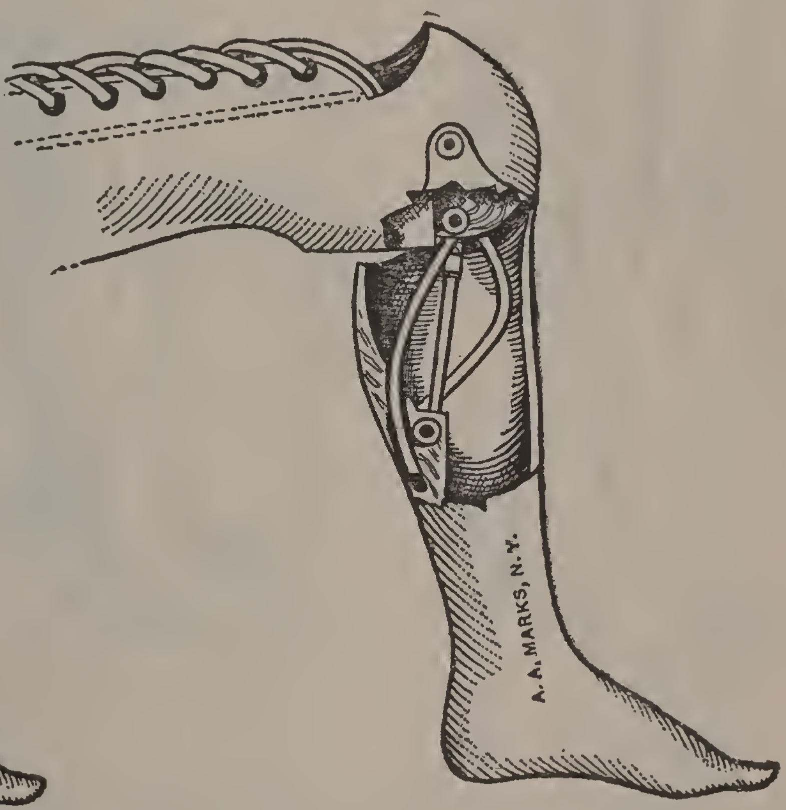
Cut E 62 shows a yoke suspender similar to the last, but provided with shoulder straps. Elastic straps buckled into the attachments connected with the thigh piece are used to fasten the yoke to the leg. This method is necessary for small hips and in cases where entire support from the hips or pressure about the loins or over the abdomen cannot be tolerated.

The corset style is frequently preferred by women. It consists of strong elastic straps secured to the lower part of the corset, one in front and one at the back as shown in Cut E 63; they are buckled into straps secured to the upper part of the thigh piece.

part from the knee down is hollowed out to reduce the weight. The exterior dimensions are as close to those of the natural leg as conditions will admit. The foot is of rubber with spring mattress as previously described.

Bolt Joint.—Cut F 6 shows the knee mechanism with the parts separated: *a* is the knee-bolt which holds the leg and thigh sections together, forming an axis for the knee. It is flanged on

Cut F 7.

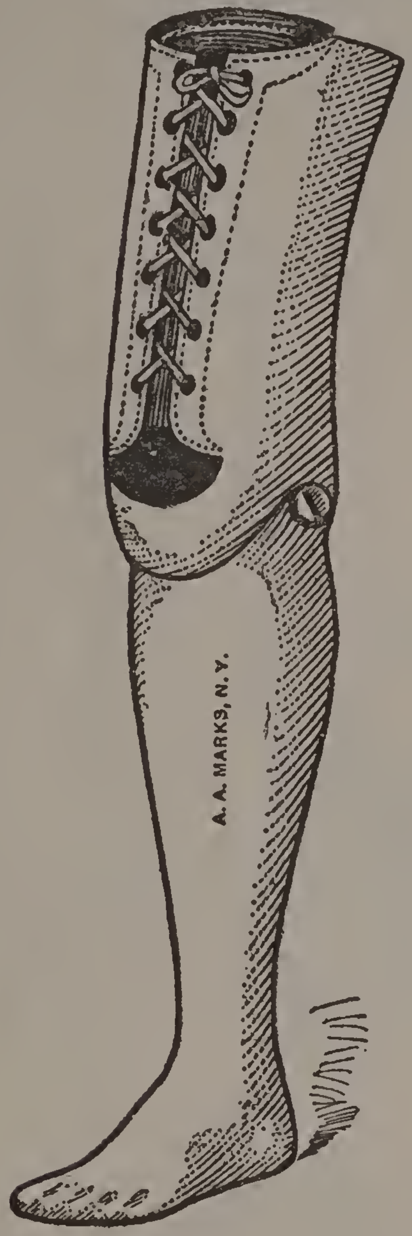


Cut F 8.

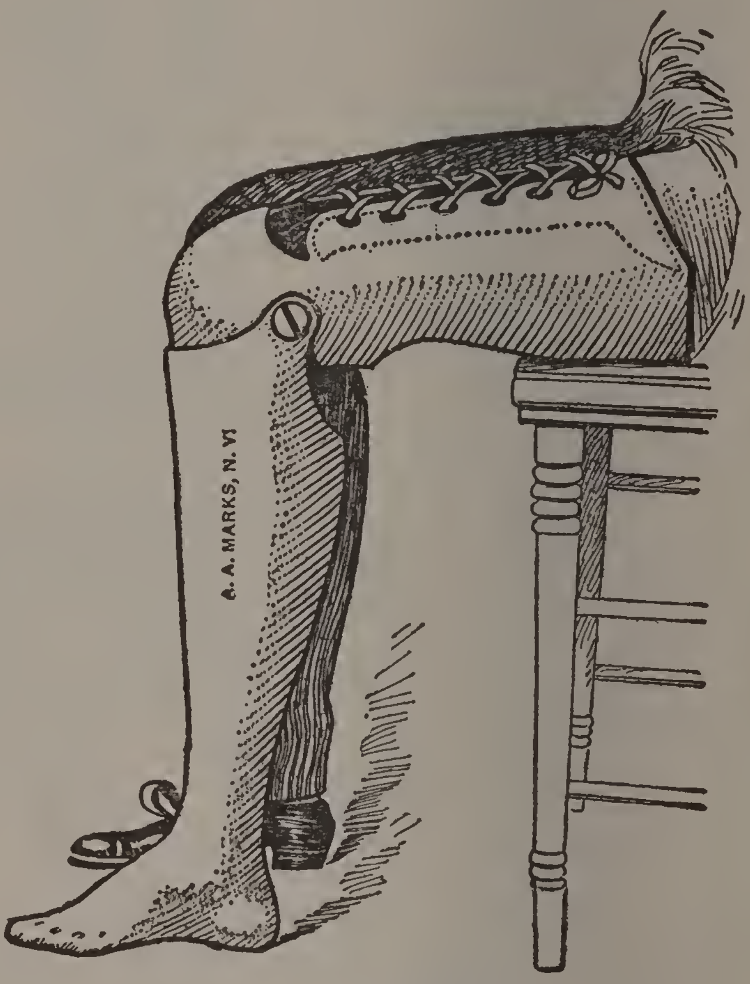
one end and threaded on the other. When the bolt is passing through the metal ear which is riveted to the lower leg the head sinks into its bed and the threaded end screws into the ear riveted to the opposite side. The set screw *b*, placed into the flanged end, prevents the bolt from moving and working out; *c* is the check cord screw; *d* the check cord; *g* the spring piston; *h* the spiral spring; *i* the cylinder. The relations and functions of these parts can be understood from an examination of Cuts F 7 and F 8, which show the leg with the knee extended and fully flexed.

The action of the spring holds the leg at flexion when the wearer is seated, and urges the leg forward when walking. The

range of articulation can be regulated by means of pads placed between the lower end of the check cord and the bridge under which it passes. These pads can be reached through the opening in the calf of the leg. The upper loops of the check cord rest in



Cut F 9.



Cut F 10.

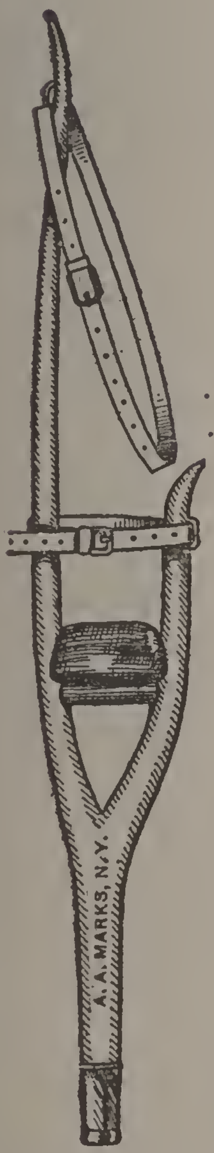
their respective channels and through them a steel screw is passed and set.

The mechanism of the knee-bearing leg is very durable, and will stand severe use for years.

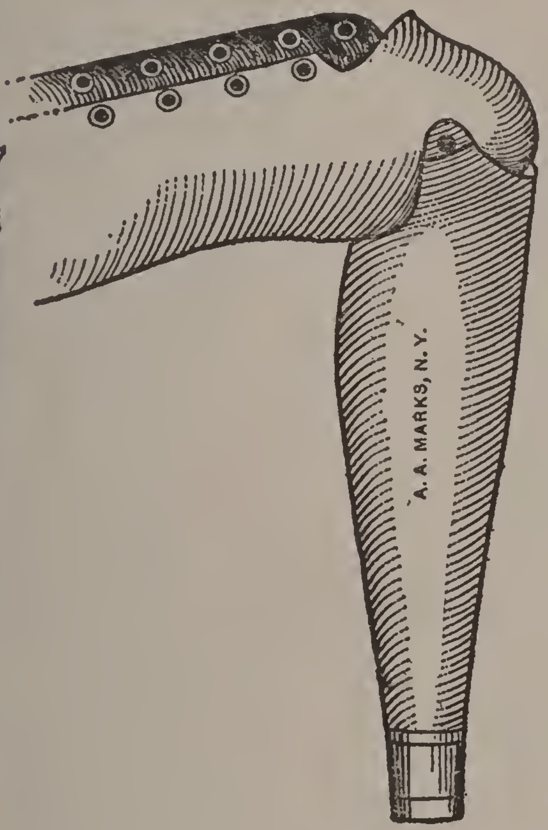
Side Joint.—The center of motion being placed below the natural knee, causes a disparity in the lengths of the two thighs; only noticeable, however, when the wearer is seated and subjected to close scrutiny. The durability of the knee-joint mechanism in style of leg shown in Cut F 5 fully compensates for excessive length of thigh, moreover, this mechanism admits of the minimum width of the knee. The choice of style remains with the wearer; if he prefers the wide knee to the long thigh, and is willing to sacrifice durability, he can have the leg constructed with side joints, as represented in Cut F 9, the center of knee motion of which is brought to the sides of the knee by means of hinge

joints, of the style shown in Cut E 23, page 52. The knee-check cord is practically the same as that represented in Cut F 6. Cut F 10 shows the leg applied, wearer seated with knees flexed.

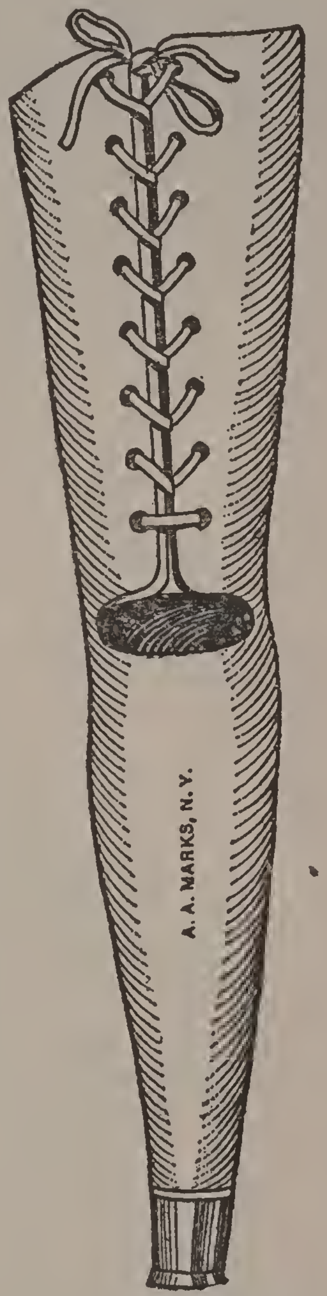
Peg Legs.—Peg legs for knee-bearing stumps are of three kinds; and will be considered in their order: Cut F 11 shows the cheapest form of peg leg for a knee-bearing stump; its construction is of



Cut F 11.



Cut F 12.



Cut F 13.

bent wood with metal ferrule, rubber tips, and leather strappings. Cut F 12 shows a peg leg with knee joint suitable for a knee-bearing stump.

Cut F 13 shows a peg leg without knee articulation for knee-bearing stump. The upper parts, F 12 and F 13, made of wood and leather, fitted to receive the stump, which is held in place by lacing.

The ends of peg legs are terminated by metal ferrules and rubber tips as described in Cuts E 57, E 58, and E 59, page 71.

Incomplete Restoratives.—For reasons heretofore given, we do not advocate peg legs for knee-bearing stumps and only fur-

nish them when they are especially ordered. It is far better for a person to procure a complete artificial leg with rubber foot, with spring mattress, one that will possess all the elements necessary for helpful and convenient walking, even if he has to deny himself in other ways in order to obtain one. A peg leg is a makeshift, and will in all probability weaken or destroy what knee motion remains.

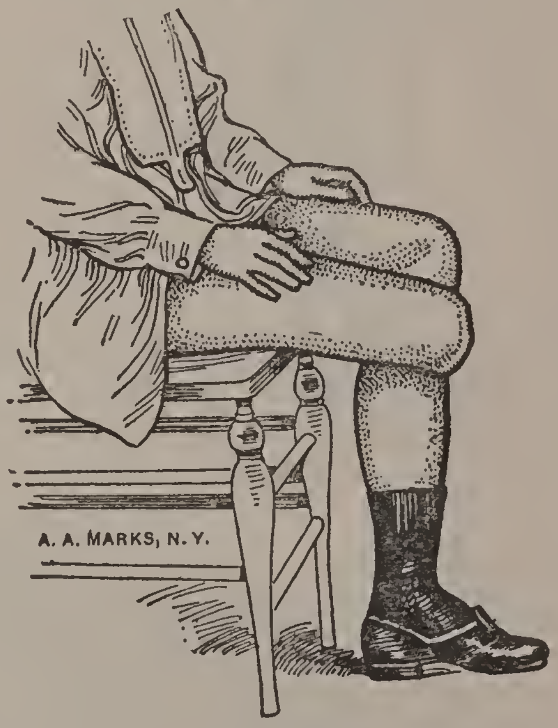
Suspenders.—Suspenders suitable for knee-bearing legs are substantially the same as those employed for tibial stump legs. The details are given in the preceding chapter.

CHAPTER VII

DISARTICULATED KNEE STUMPS

End-Bearing and Non-End-Bearing Stumps. — Amputations through the articulations of the knees call for careful prothetical consideration. Stumps resulting from such amputations may be end-bearing or not; when they are covered with tissue flaps, free from cicatrices and nervous complications, they are end-bearing; if they are cicatrized, and sensitive, pressure must be applied elsewhere; if they are tapering to the ends or are broadened at the

Cut G 1.



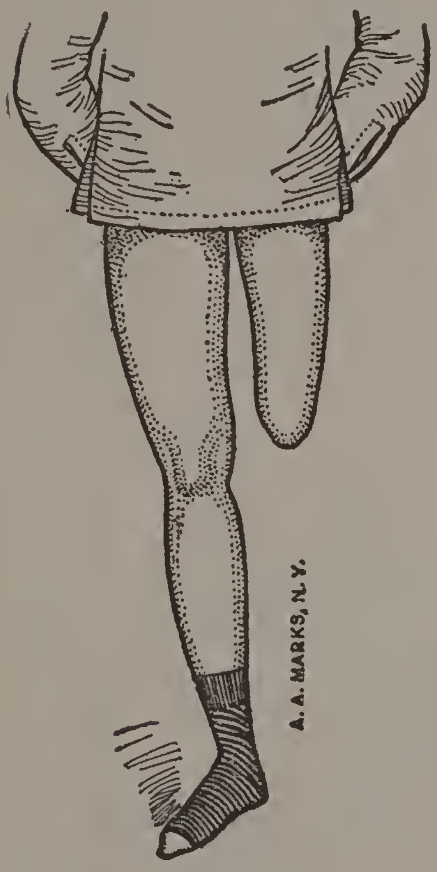
Cut G 2.

extremities they must be treated accordingly. The presence of the patella, securely united in the intercondylar space, will improve the character of the stump, but if it is not united it is doubtful if the end will tolerate any weight whatever.

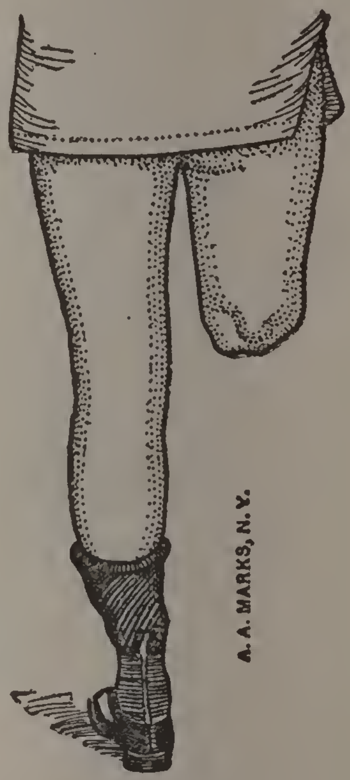
Fittings.—Artificial legs for knee-joint amputations must admit of placing pressure only on parts capable of enduring it. Tender, delicate, sensitive, and irritable spots must be guarded, and non-end-bearing stumps must be provided with limbs that will

take the weight at the ischial and perineal regions; if the sides of the stumps are sloping a share of the weight can be distributed over those parts. Sensitive condyles, bony prominences, and fascia must be properly cared for.

Peculiarities of Stumps.—Cut G 1 shows a type of stump resulting from knee-joint amputations; the nodulous extremity due to the presence of condyles, together with ample coverings, provide desirable conditions. An artificial leg suitable for this stump is so fitted that the weight is carried on the end, which rests on a padded surface at the lower end of the socket, and held securely in place by the leather lacing. The shoulder suspension is greatly simplified when condyles are present in the stump. Cut G 2 shows



Cut G 3.



Cut G 4.

a side view of a stump favorable for end pressure. Cut G 3 shows a stump reaching to the knee, patella present and without cicatrices, thus admitting of end pressure.

Cut G 4 shows a thigh stump reaching to the knee and extremely well protected, with cicatrices at the rear and well away from the end; bunches of sensitive tissue hanging from the extremity prevent the application of weight at that point. Cut G 5 shows a thigh stump reaching to the knee with an end incapable of bearing pressure; the condyles and all the natural coverings of the bone were removed in the operation. Bunches of tissue and ganglia were gathered at the end back of the stump. The muscle tissue puckered considerably and the presence of cicatrices on and about the end prevents the application of weight there. Cut G 6 shows a stump reaching to the knee, condyles present, the extremity covered with integumentary folds, deep fissures and

cicatrices, preventing the application of weight upon the extremity.

Most Favorable Conditions.—These examples develop the following points: Stumps extending to the knee with nodulous extremities, capable of bearing weight, are the most favorable of all knee-joint stumps. They result from amputations through the

Cut G 5.

Cut G 6.

knee articulations, the condyles remaining untrimmed, or, if trimmed, the ends protected by bone and muscle flaps; the natural coverings to the bones permitted to remain on the articulating surfaces; the patellas, if present, firmly united to the end of the femur; flaps well carried to the posterior and the cicatrices some distance from the ends. Stumps possessing these favorable conditions can be efficiently accommodated with artificial legs that will minimize the pressure about their upper borders and simplify the mode of suspension.

A stump reaching to the knee, with a nodulous extremity and incapable of bearing weight on the end, is capable of operating an artificial leg, but the means of attachment are necessarily more extensive and more severe than when the weight can be borne on the ends.

Inability to bear weight on the extremities of knee-joint stumps is not always due to surgery.

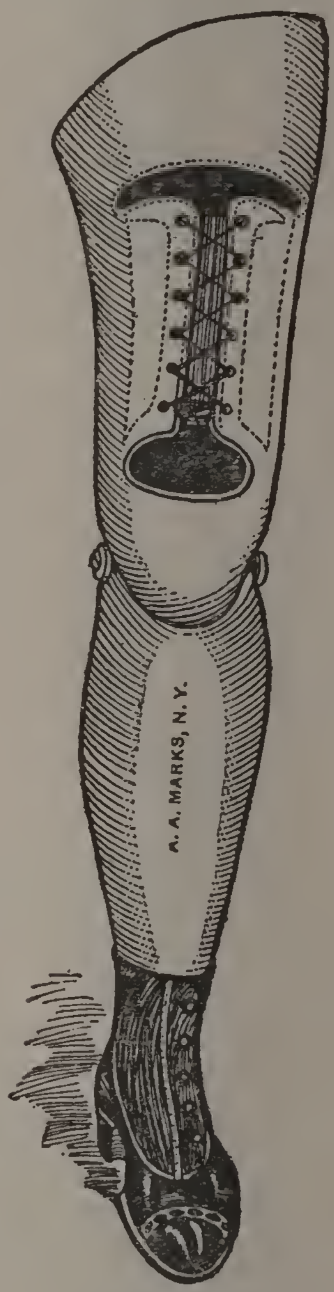
Sloughing, bone degeneration, hyperæsthesia, etc., frequently occur despite the most careful precautions of the operator.

Suitable Artificial Legs.—The foregoing cuts illustrate stumps that can be advantageously fitted with artificial legs con-

structed upon plans of those shown in Cuts G 7 or G 8, according as the stump is tapering or straight, or whether the end can endure weight or not. The thigh of either leg is made partly of wood and partly of leather. The rear section is of wood, excavated to receive the stump in the most comfortable way. The front portion is of leather arranged for lacing as shown. If the stump is tapering to the end there will be no advantage in having the front laced, the entire socket can be better constructed of wood.

Cut G 7 illustrates a leg made to place a large amount of the weight of the wearer directly on the extremity of the stump. Cut

Cut G 7.



Cut G 8.

G 8 shows a leg with annular top designed to hold the end of the stump away from the bottom of the socket, all the weight being distributed over the sides, above the knees and about the top borders of the socket. In both these styles every requirement for the comfort of the wearer and the efficiency of the leg is considered.

The stump socket of either leg is of proper size and shaped to receive the stump and carry the weight of the wearer.

Both upper and lower sections are made of selected kiln-dried wood, carved to the shape of the stump with external proportions as near those of the natural leg as the conditions will admit. The lower leg is excavated to reduce weight. The foot is of rubber as heretofore described, and both leg and thigh are coverd with suitable material properly enameled. The knee mechanism is the same as that illustrated in Cuts F 6 and F 7.

Suspenders for legs for knee-joint amputations are the same as those applied to thigh amputations, and are fully treated in the following chapter.

We point with pride to many thousand persons who walk on artificial legs of either the above type with efficiency and naturalness and who voluntarily bear witness to the excellence of the manner in which they have been fitted out, and their increased capabilities to perform their full share of work.

CHAPTER VIII

THIGH OR FEMORAL STUMPS

Definitions.—Thigh or femoral stumps are those that reach to any point above the knee joint; they are designated upper-, middle-, or lower-third thigh stumps, according to their lengths, in relation to the three divisions of the thigh.

Long or Lower-Third Thigh Stumps.—When a stump reaches to a point in the region of the lower third, it is commonly termed

Cut H 1.

Cut H 2.

a long thigh stump, a few of which are illustrated in Cuts H 1 to H 4.

Artificial legs suitable for such are illustrated in Cuts H 5 and H 6.

In cases of long and flabby stumps the number G 7 leg, see page 82, can be applied to advantage.

Stumps out of Line.—Persons walking on crutches for a considerable length of time permit their stumps to incline forward. The flexors in the groin become contracted and the extensors yield to the influence, and the stump assuming the position, when hanging at ease, of that shown in Cut H 1, and occasionally that

shown in Cut H 3. This condition should not cause anxiety on the part of the wearer, as it can be controlled and corrected by a suitably attached artificial leg.

CONSTRUCTION OF LEGS.—The thigh and leg sections of H 5 are constructed of wood of choice character. The socket is hollowed

Cut H 3.

Cut H 4.

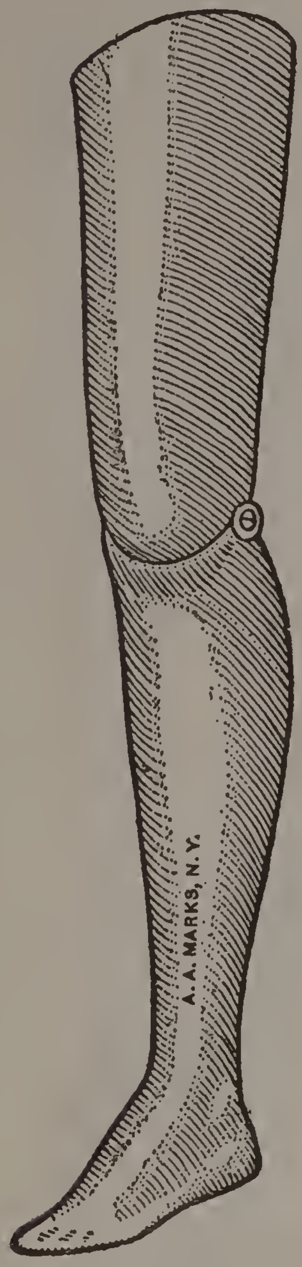
out to receive the stump properly, and to receive the weight of the wearer where it can be tolerated.

The outside dimensions both above and below the knee are dressed down to the curves and dimensions of the natural leg as far as conditions will admit. The lower part excavated to minimize weight, both sections are covered with rawhide and enameled, the foot is of sponge rubber with spring mattress as heretofore described. The manner in which the knee joint is constructed is substantially the same as shown in Cut F 6, and described on page 74.

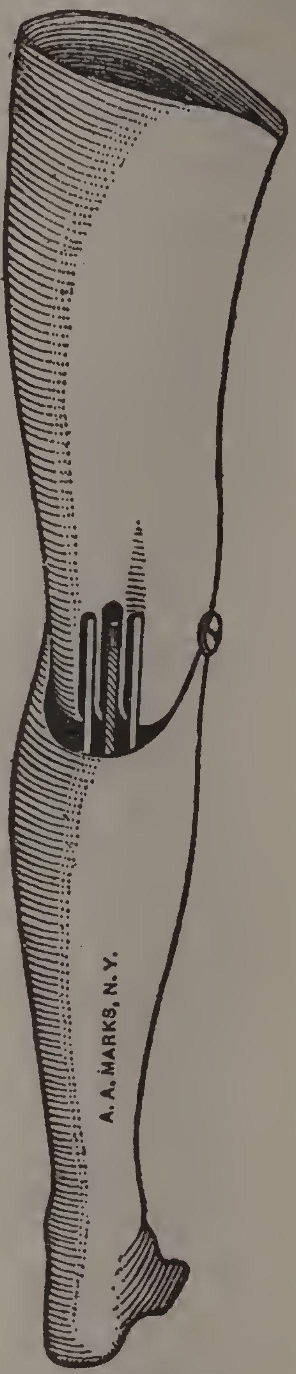
VARIETY OF MIDDLE-THIRD THIGH STUMPS.—Thigh amputations through or above the middle thirds produce stumps that admit of the simplest form of knee-joint mechanism, called the T joint, explained further on.

Cuts H 7 to H 14 show thigh stumps of a variety of lengths with flaps and cicatrices of many characters.

END AND NON-END-BEARING.—As a rule thigh stumps are incapable of taking weight on their extremities, and as there is but little advantage in putting pressure on that point, and as the risk of doing so is very great, we rarely consent to construct limbs



Cut H 5.



Cut H 6.

Cut H 7.

Cut H 8.

in that way and only do so when we are positive that the ends of the stumps will not be injured. Cut H 15 shows the usual type

Cut H 9.

Cut H 10.

Cut H 11.

Cut H 12.

of artificial leg for a thigh stump. The thigh and leg sections are made of tough, light, bass or willow wood, shaped to the size and

contours of the natural leg so far as conditions will permit. The thigh is excavated to receive the stump in the best way, permitting pressure only at admissable places. The end of the stump, together with a few inches of the thigh, are, as a rule, required to hang in space, all the weight being applied to the upper borders of the thigh socket and along the sides of the stump immediately adjacent to the body. When weight can be prudently applied to the end a cushion is provided for that purpose. The lower section of the

Cut H 13.

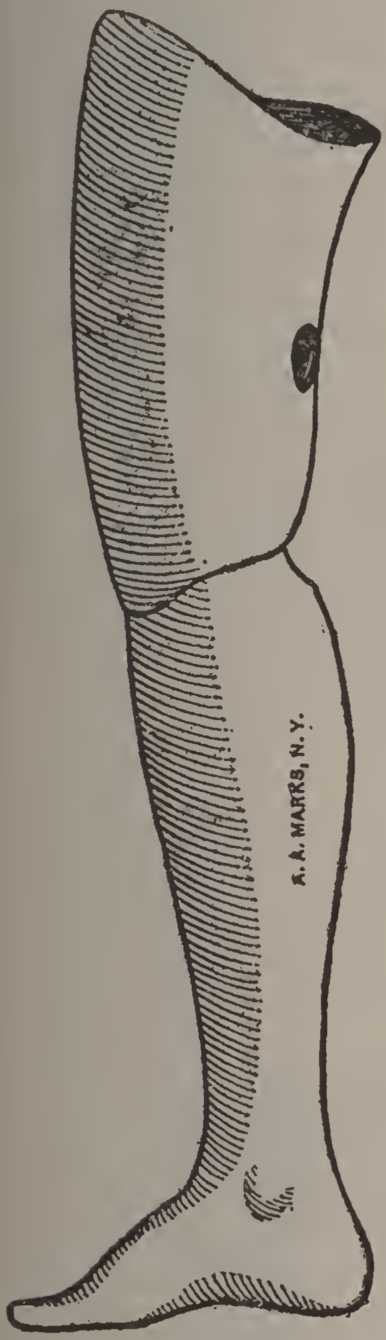
Cut H 14.

leg is excavated to reduce weight. The whole is covered with rawhide and elegantly finished with a flesh-tinted enamel.

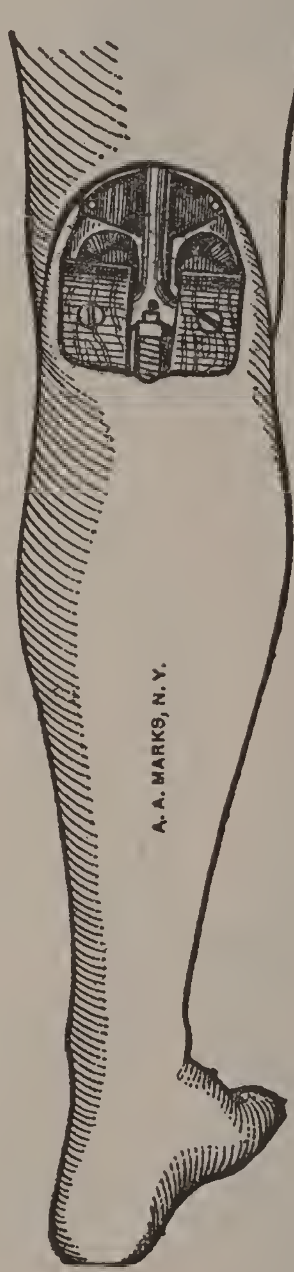
A rubber foot with spring mattress as heretofore described, is properly attached at the ankle. Cut H 16 represents the rear view showing the knee mechanism with parts together, and Cut H 17 represents the working parts of the knee separated. Cut H 18 shows the T joint, the spring, and their connections; *a* is the T joint which is secured to the knee block located at the lower end of the stump socket. The two arms work in journals made in the leg section; *bb* are the cap screws that hold the T joint to its place; *cc* the caps; *d* the spring piston; *e* the spiral spring; *f* the cylinder; *g* spring cover, and parts of the spring together; *iii* represent the steel screws used to hold the T joint firmly to thigh. The joint *a* has the shape of an inverted T, hence its name, T joint. It is made of gun metal forged from one piece, turned,

drilled, and finished on the lathe. When the leg and thigh sections are placed together the arms of the T joint rest in boxes and are held by two hardwood caps, *cc,* which are secured by long steel screws, *bb,* which depend for their security on steel nuts, imbedded in the front part of the leg.

THOROUGH CONTROL.—The wearer has thorough command over this joint; the pressure of the caps on the joints can be regulated



Cut H 15.

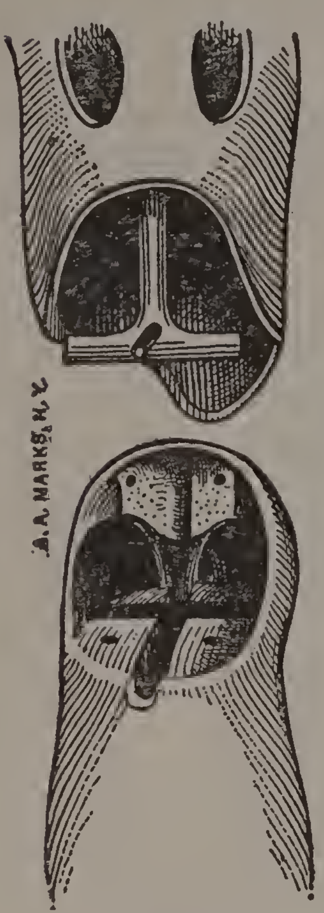


Cut H 16.

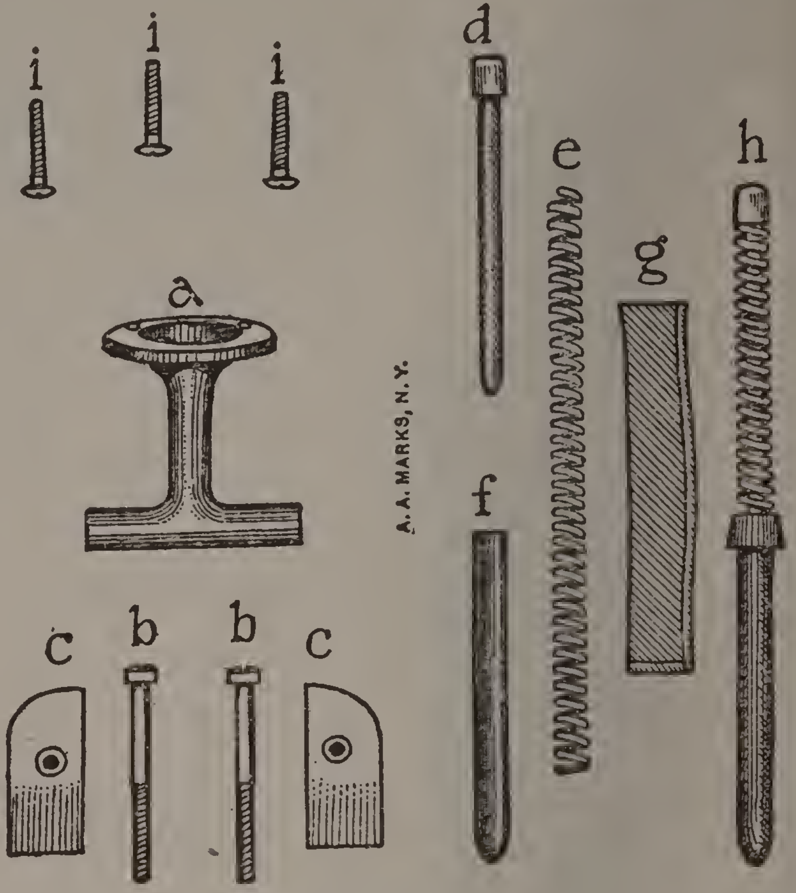
by the screws, and thus any desired tension on the articulation be made.

KNEE SPRING.—The small steel lever with ball on the end, projecting from the back of the joint, operates in the cavity of the hardwood piston *d;* the piston is inserted in one end of the steel spring, *e,* which has its lower part encased with leather *g,* and then placed in a drawn metal cylinder *f.* The lower convexed end of the cylinder is received on a bridge placed in the interior of the leg in the region of the calf.

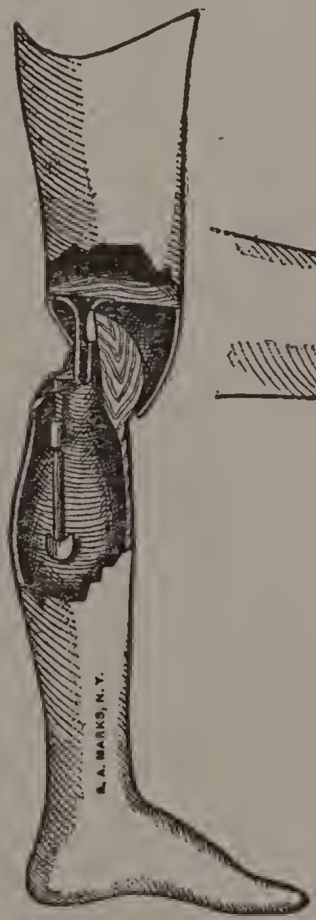
Helps Knee Motion When Walking.—The operation of the spring is twofold; it urges the lower leg forward in walking, and



Cut H 17.

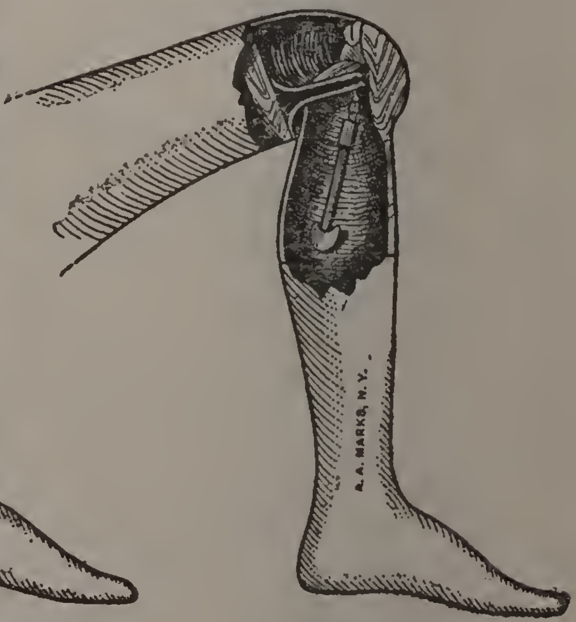


Cut H 18.



Cut H 19.

Cut H 20.



Cut H 21.

holds it at full flexion when sitting. This is done in the following manner: When the leg is extended, the point at which the

spring pressure is applied is on the end of a steel lever projecting an inch back of the center of motion in the knee. This urges further extension, as shown in Cut H 19, the lever revolves with the joint; and when the leg is partly flexed, as shown in Cut H 20, it has been carried to a neutral point where the spring neither urges flexion nor extension; but when the knee is further flexed, as shown in Cut H 21, the lever has passed forward of the neutral line and the spring forces the ball upward, urging greater flexion; and when the flexion is at its limit the leg is kept in that position by the spring. Thus the objection to the usual spring knee articulation is removed, that of the tendency of the leg to fly out when the wearer is sitting and unguarded.

Spring Strength Can be Regulated.—The power of the spring in the knee can be increased or diminished. If it is desired to increase it, a little packing can be tamped in the cylinder, or a longer spring can be substituted; and if it is desired to diminish it, a coil or two of the spring can be cut off or a shorter one substituted. If the wearer does not want the spring he can take it out and discard it. When the leg is together and in working order, the knee movement is arrested by the striking of the vertical shaft of the T joint against a pad placed in the knee, which can be increased or diminished by the wearer, and the range of articulation in the knee made less or greater, as may be desired.

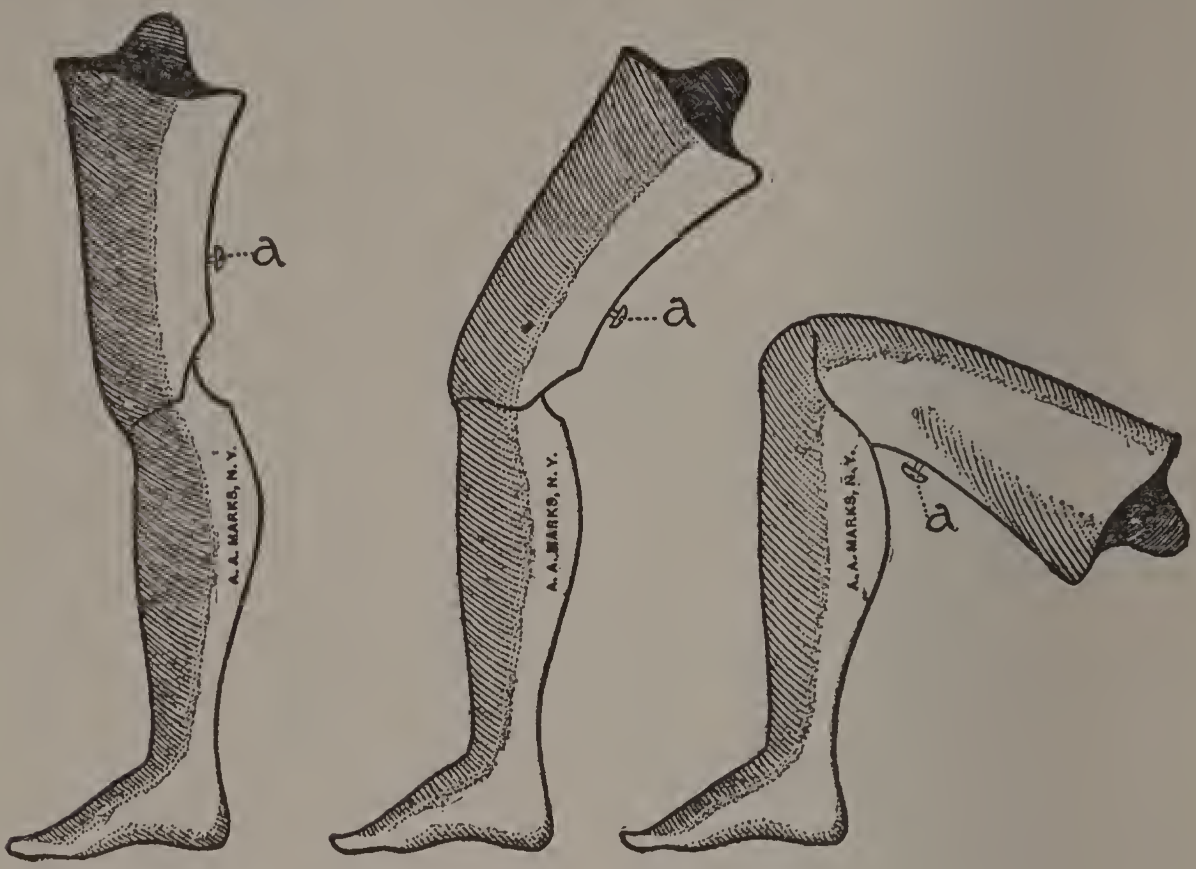
The center of motion of this knee is placed considerably back of the center of gravity of the leg in order to secure the knee against treacherous bending.

Knee Lock.—The knee lock is a device placed in the knees of artificial legs to keep them from flexing, or from flexing beyond a fixed limit. When the wearer wishes to sit the knee can readily be unlocked. It is not very often that knee locks are required, therefore they are only placed in artificial limbs when conditions demand.

Cut H 22 shows an artificial leg with knee lock for thigh stump; *a* is a sliding bar that can be moved upwardly or downwardly. When down the leg is incapable of moving at the knee, or is permitted to move only through a limited angle, as shown in Cut H 23. When the sliding bar is pulled up, the lock is out of action, and the knee can be bent at right ankles as represented in Cut H 24.

This device is found to be of value to those who have short, weak, or deflected stumps, and is also used to advantage by equestrians. We have a patron, a baptist clergyman, who finds the knee lock indispensable when performing the rites of immersion; because of the buoyancy of the lower leg the knee without the lock would flex the moment he enters the baptismal font. Knee locks are used to advantage by persons who are required to walk through obstructions, such as underbrush, heavy grass, snow, etc.; without the locks these obstructions are likely to flex the knees inopportunely. Hip joints and waist belts are occasionally attached to the thighs of these legs.

Hip Joints.—The knee lock, hip joint, and waist belt can be combined to advantage in legs applied to stumps that are deflected, abducted, or that in any way incline out of the normal lines. The knee lock places the knee beyond the influence of the partly flexed stump, and the hip joint places the leg beyond the influence of



Cut H 22. Cut H 23. Cut H 24.

the abducted stump. As these auxiliary parts complicate the construction of the leg, add weight, and more or less hamper graceful and natural walking, it is not considered desirable to add them unless the conditions of the stump or the occupation of the wearer demand.

Waterproof and Bathing Legs.—Persons wearing artificial legs on thigh stumps frequently find it desirable to use their artificial legs while they are bathing or swimming in salt or fresh water. It is embarrassing to those who have but one leg to be viewed with curiosity while hopping or walking with crutches or hitching on hands and knees on the shore. This embarrassment often prevents them from indulging in the exhilarating and health-giving river, lake, or ocean bath.

An artificial leg especially designed for swimming and bathing purposes is constructed practically the same as those heretofore described, differing only in the fact that they are absolutely waterproof, the knee to articulate or not, as the wearer may elect. As the wearing parts of waterproof legs are made of composition instead of steel, they are not as durable as those made for ordinary purposes; they are therefore only made when especially ordered.

Legs Without Knee Joints.—We have on a number of occasions been required to construct artificial legs for thigh stumps without

knee joints. Cut H 25 shows an artificial leg of this type. The entire structure, including the foot core, is carved from a single piece of wood, slightly curved at the knee so as to represent the natural leg when partly flexed, for better accommodation when sitting. The foot is of rubber with spring mattress as described. The leg is covered in the usual way and enameled or waterproofed if it is to be used in watery places.

PEG LEGS—Peg legs are occasionally used on thigh stumps. They are practically artificial legs without feet. As already stated we do not advocate the use of peg legs, as they are of limited effi-

Cut H 25.

Cut H 26.

Cut H 27.

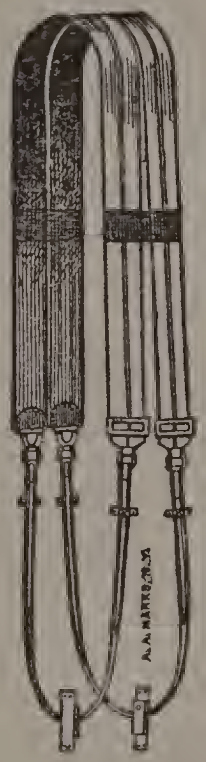
ciency. The foot is a very important part of an artificial leg. It assists in balancing, aids in walking, and restores the appearance.

Years ago before artificial legs with rubber feet and spring mattress were so generally used, the peg leg was more in evidence, but lately it is worn more as a means of disciplining the stump or as a makeshift to bridge an impecunious period.

Persons are able to stand, stump about, and perform a limited amount of labor on peg legs, which are unquestionably better than

crutches, but their restoration is not complete until they are wearing artificial legs with spring mattress rubber feet. Cut H 26 shows a peg leg for a thigh stump. It is made of suitable wood, excavated to receive the stump and reduce weight. The outside has the contours of nature as closely as the conditions will admit, the end terminating in a metal ferrule and rubber tip, as illustrated on page 71, Cuts E 57-58-59. Cut H 27 shows a peg leg with knee joint, for a thigh stump. It is constructed in all parts the same as H 15, heretofore described. The absence of the foot and the substitution of a rubber tip is the only difference.

Suspenders.—Suspenders suitable for legs for thigh amputations, as well as for amputations in the knee joint are of various kinds to suit the habits and demands of the wearers. The style of suspender which is most generally adopted is that illustrated in Cut H 28, termed the roller suspender. While it has excellent



Cut H 28.

Cut H 29.

Cut H 30.

features it has limited application. It can be used to advantage on stumps reaching to any point from the middle of the thigh to the knee, but for shorter stumps and for hip-joint amputations a method that will hold the limb to the body more firmly is necessary. The roller suspender is the product of many experiments and years of experience, assisted by the kindly suggestions of our patrons.

The shoulder straps are usually of two-inch non-elastic webbing. A strip of webbing is attached to the right strap, and forms a loop through which the left strap passes. A piece of webbing stitched to the back of both straps holds them together. The front lower ends of the shoulder straps are received into buckles, and the back lower ends are terminated by snaps; each hooks into the ends of the leather roller cords which pass around rollers attached to

either side of the leg. Any degree of pressure upon the shoulders can be obtained by means of the clamp buckles, and when obtained, the buckles are clamped and are never disturbed, unless the pressure on the shoulders needs further adjustment. When it is desired to remove the limb, the suspenders are detached by unsnapping both front and back.

Cut H. 29 shows a front view of a person wearing a pair of roller suspenders.

Cut H 30 gives the back view, and Cuts H 31, H 32, and H 33 side views.

These cuts show the relative positions of the rollers, as well as the effect of the loops in holding the shoulder straps in place and

Cut H 31.

Cut H 32.

Cut H 33.

in directing the leg. Elasticity is obtained by two pieces of elastic webbing attached to the backs of the shoulder straps a little below the shoulder blades.

The operation of the suspenders is illustrated in Cuts H 29-30-31-32-33. All the traveling of the suspenders due to changes of position takes place about the rollers on the sides of the thigh, instead of on the shoulders of the wearer, whether the person is standing, stooping, walking, or sitting.

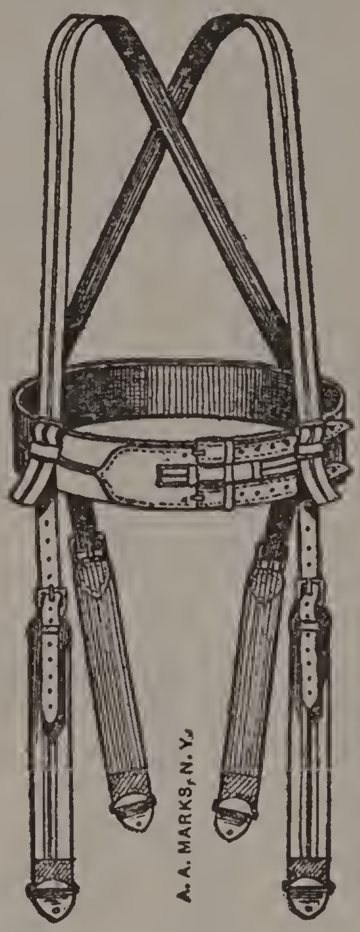
Straight Shoulder Straps.—Cut H 34 shows a style of suspender especially adapted to an artificial leg for a short thigh stump. It is the style very generally used before roller suspenders were devised. The shoulder straps are of fine elastic webbing, 2 inches wide.

The front straps are of two-inch non-elastic webbing; each front strap passes through a metal link attached to the lower end of the elastic shoulder strap. After passing through the metal link the front straps are received into a two-prong buckle. The sus-

penders are attached to the leg by means of leather tags and metal D's screwed to the back and front. The metal D admits of side motion, thereby insuring direct pull.

Belt Attachment.—Cut H 35 represents a belt and suspender combined. The shoulder straps and belt are preferably of non-elastic webbing. The straps running from the belt to the leg are

Cut H 34.



Cut H 35.

Cut H 36.

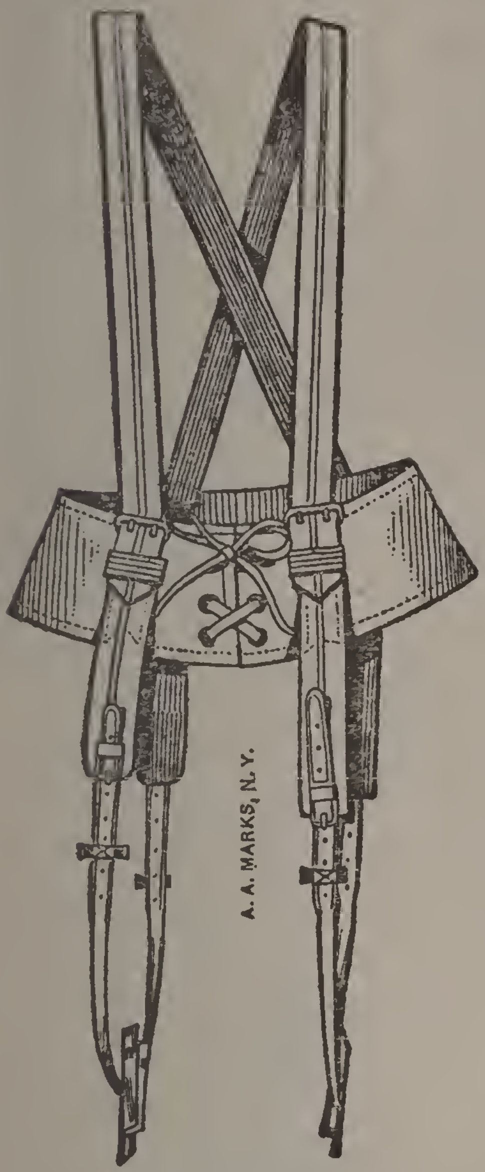
made of elastic webbing, 2 inches wide or less, as the case may demand.

Vest Method.—Cut H 36 illustrates the vest method. It is made of strong muslin, fitted to the person and worn under the shirt. Elastic straps are attached to the lower border and buckled into straps that are secured to the leg. In order to obtain the best results, the vest must be made and fitted by a tailor. Persons who desire to have their artificial limbs constructed from measurements, and choose the vest suspender, are required to have vests made at home, and if sent to us, we will attach the straps and make the proper connections with the leg without additional charge.

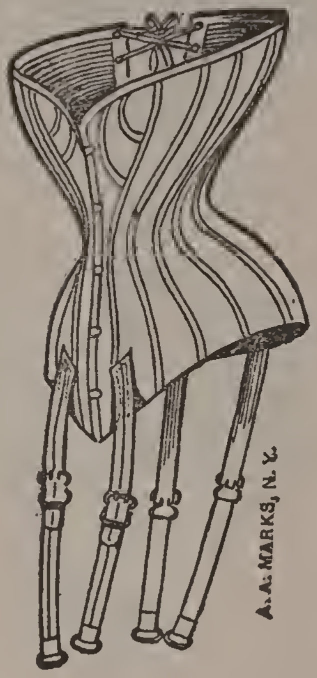
Suspenders for Women.—For obvious reasons the means of suspending artificial limbs to women differ from those employed with men. When shoulder straps are used they must pass over the shoulders and not press upon the breasts. Yokes, girths, or bands must pass around the waists so as to place the burden all or in part on the hips.

Yoke Method.—Cut H 37 shows a combination of the roller straps with the yoke; rollers or pulleys are secured to the sides of the thigh, and leather cords pass around them. The yoke is made

to fit the loins and hips, adjustable by lacing in front or on the sides, as may be preferred; the shoulder and roller straps are also



Cut H 37.



Cut H 38.

adjustable, so as to bring the proportionate weight about the shoulders and hips without displacing the yoke.

Corset Method.—As many women pride themselves on their trim waists and neat-fitting garments, it is especially desirable that means of leg suspension should be light and neat. Straps securely sewed to the corset, extending downward and connected with the artificial limb, admit of the neatest adjustment. Cut H 38 shows the corset method, which can be easily adjusted by the wearer.

CHAPTER IX

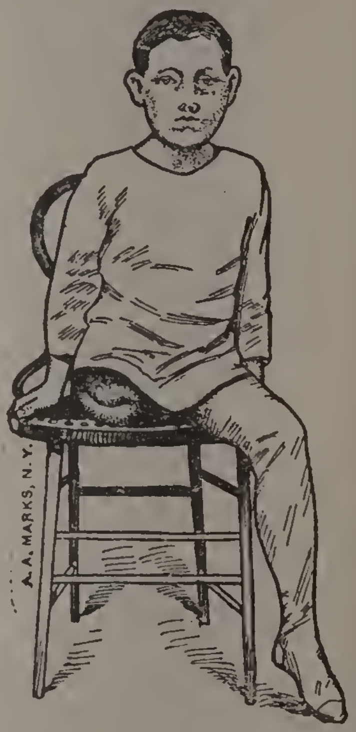
HIP-JOINT AMPUTATIONS

Requirement.—An amputation at the hip joint or close to the body requires an artificial leg identical in construction to either of the patterns heretofore described for thigh stumps, with the exception that some modifications are introduced in the knee and the means of suspension is more complex.

Muscle Stump.—Cuts I-1 and I-2 illustrate front and side views of amputations at the coxo-femoral or hip articulation, leaving a stump composed entirely of muscle tissue. A muscle

Cut I-1.

Cut I-2.



Cut I-3.

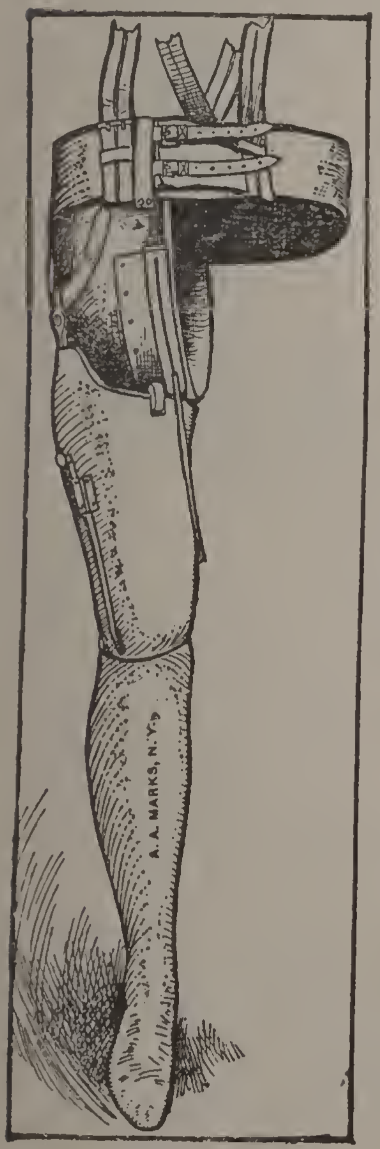
stump is capable of performing some functions, although limited, in the management of an artificial leg, and may be considered as more desirable than no stump at all. Cuts I-3 and I-4 represent a hip-joint amputation in which there is no protruding stump by which the artificial leg can be directed. The amputated surface at the base of the pelvis is capable of bearing pressure.

Leg Applied.—Cuts I-5 and I-6 show a leg applied to hip-joint amputation having muscle stump. The means by which it is suspended consist of a waist belt, shoulder strap, over each shoulder, flexion and extension elastic straps, a metal hip joint

Cut I-4.

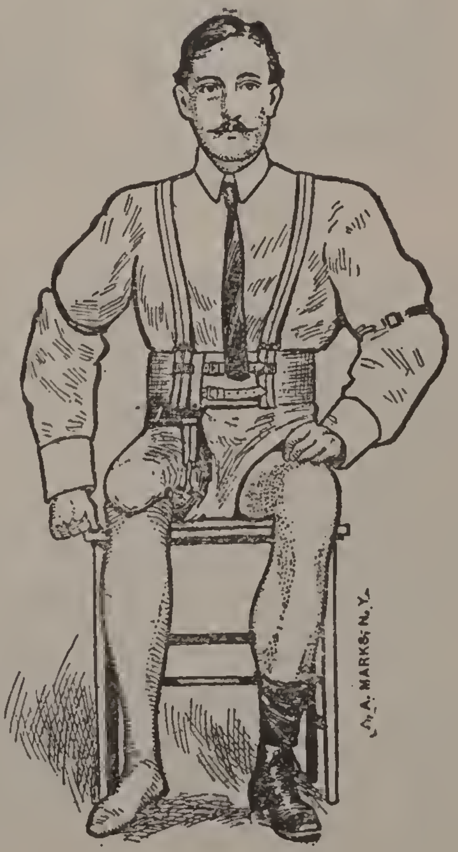
Cut I-5.

Cut I-6.



Cut I-7.

Cut I-8.



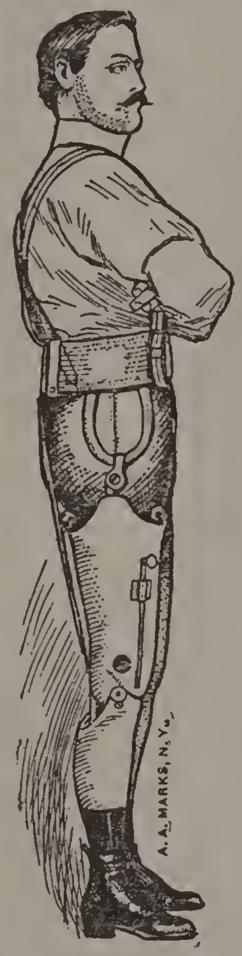
Cut I-9.

substituting the natural hip articulation, and an attachment by which the knee can be locked and made immovable, or capable of having but limited motion, these features have all been explained in the preceding chapter.

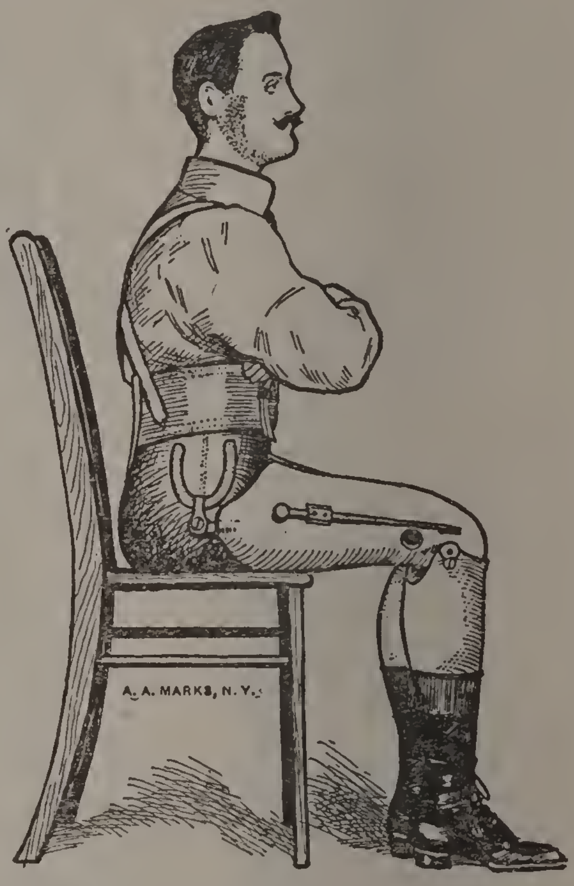
The hip joint is important as it keeps the artificial leg directly under the wearer. The waist belt with its elastic straps front and rear assists in flexing and extending the leg at the hip. The leg is held firmly to the body when standing or walking; it should be especially noted, that it is not advisable to allow any knee motion while the wearer is learning to control the leg. During this period the knee motion is only for sitting convenience.

Cut I-7 shows a leg with pelvic socket suitable for a hip-joint

Cut I-10.



Cut I-11.



Cut I-12.

amputation where there is no protruding stump to control the artificial hip motion.

Cuts I-8, I-9, I-10, I-11, I-12, show the leg applied and the wearer in many positions. The pelvic socket takes in a part of the pelvis and holds the artificial leg firmly to its place no matter what positions the wearer may assume. The hip joint is controlled by throwing the body forward or backward of the center of gravity of the leg.

Artificial legs for hip-joint amputations support the amputated side in a very comfortable and natural manner. The leg, having little or no stump to control it, is thrown forward by means of a side motion of the body. Persons with reasonable perseverance soon learn to control legs under these conditions in an advantageous way.

CHAPTER X

BOTH-LEG AMPUTATIONS

The triumphs of artificial limb-making are shown to advantage in the restoration to active life of those who have had both of their lower extremities removed. When such persons are enabled to get about freely, walk gracefully, and engage in such labors as their callings in life require, a great and beneficial work has been accomplished, and the strongest possible evidence is presented to show that the mind of the prothesist has not been passive during

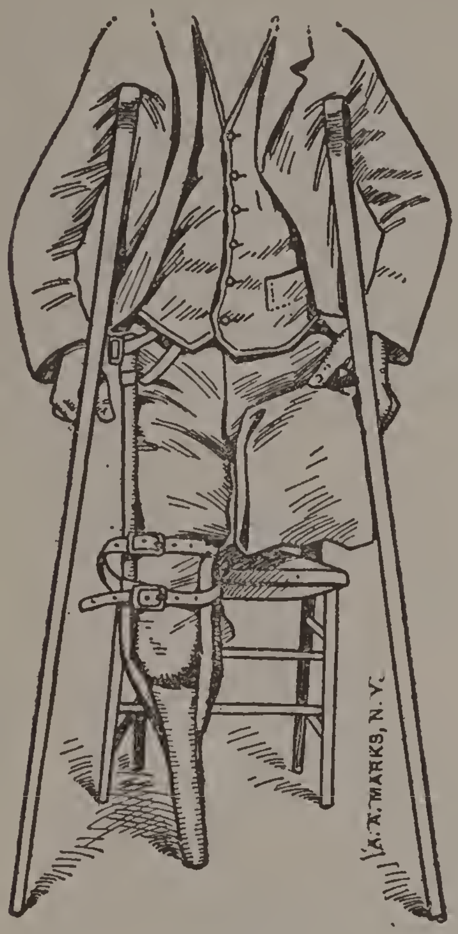
Cut J 1.

Cut J 2.

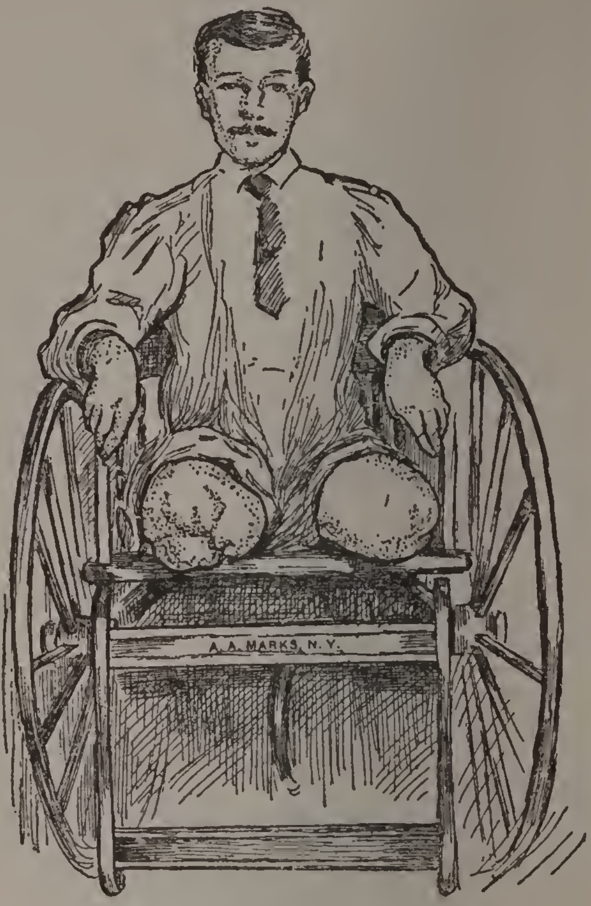
the past half century. The problems these cases present are profoundly difficult, thought and effort have never been given to more laudable purposes than to their solution. The amelioration of the conditions of these unfortunate persons commands the highest talent and the most humane impulses.

Ancient Methods.—But a short time ago the loss of both legs was regarded as irreparable. The person who met with that misfortune was either consigned to a wheel chair, or obliged to hitch himself about on his knees or haunches. Cuts J 1 to J 4 show some of the various methods employed by those deprived of both their limbs. Formerly these methods were the only means for

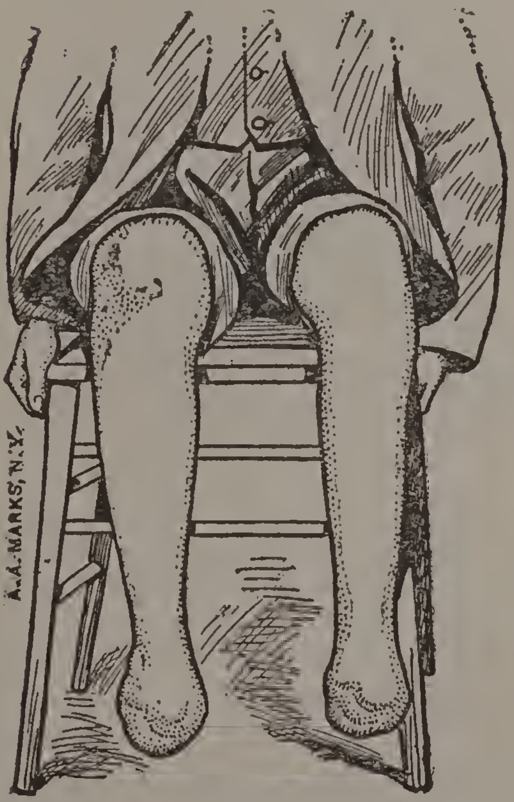
locomotion the subject could employ. But at the present time the methods are used preliminary to obtaining and wearing arti-



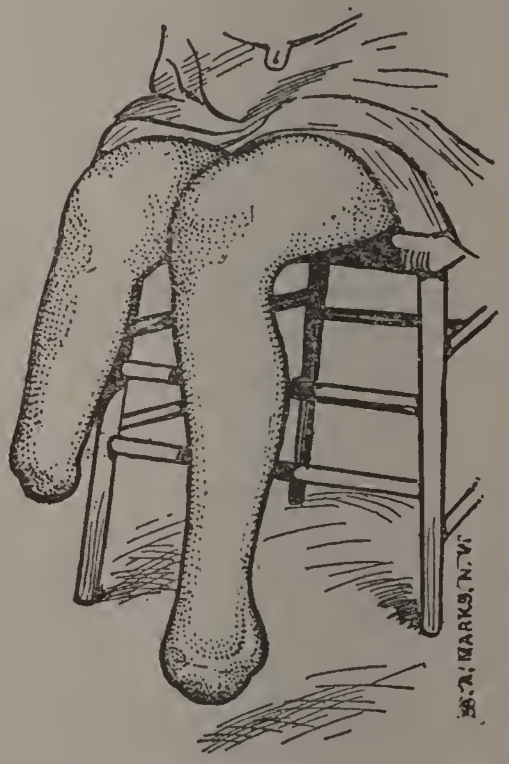
Cut J 3.



Cut J 4.



Cut J 5.



Cut J 6.

ficial legs. When these methods are contrasted with those that are shown later on, the progress and developments that have been made in the adaptation of artificial legs will be in plain view.

Both Feet Partly Amputated.—Cut J 5 shows a case in which

both feet were removed at the insteps; a pair of artificial legs constructed on the plan of Cut C 18, page 32, was applied.

LOWER INSTEP AND LEG AMPUTATIONS.—Cut J 6 shows an amputation of the left foot at the instep and of the right leg at the junction of the lower and middle third. Artificial legs C 18 and E 17 were applied.

BOTH FEET AMPUTATED AT THE ANKLES.—Cut J 7 shows a double ankle-joint amputation with the extremities incapable of

Cut J 7.

Cut J 8.

bearing pressure. A pair of artificial legs, constructed on the plan of D 21 and described on page 43, was applied. Cut J 8 shows the same case with the legs applied and the wearer standing. In this particular instance the amputations resulted from frostbite, and the extremities of the stumps were very sensitive and with impaired circulation. It was therefore necessary to avoid interference with circulation and to secure the absolute freedom of the extremities from contact.

ANKLE JOINT AND KNEE AMPUTATIONS.—Cut J 9 shows an amputation of the left foot at the ankle after the Pirogoff method, and the right leg at the knee joint after the Gritti operation;

Cut J 9.

Cut J 10.

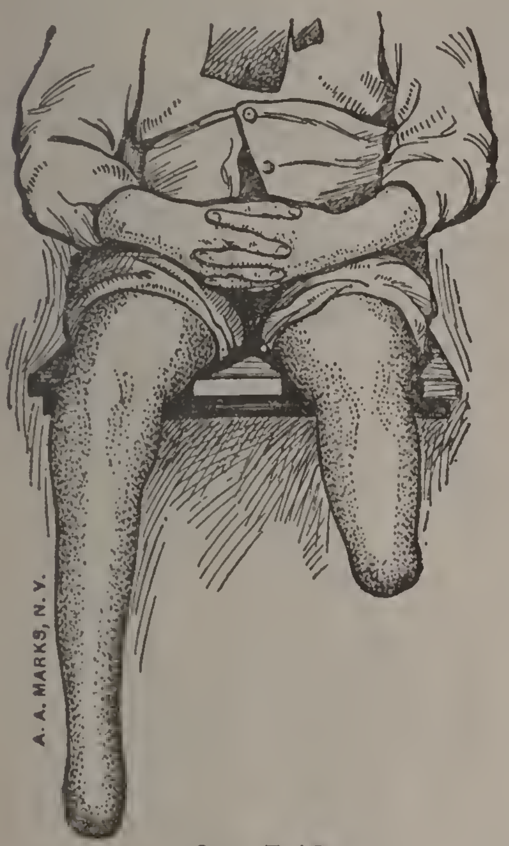
Cut J 11.

Cut J 12.

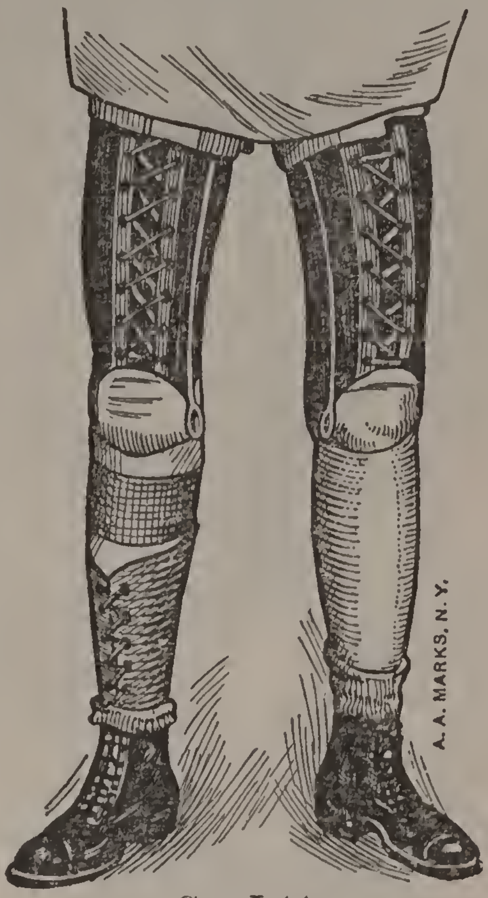
artificial legs D 12 and G 17 were applied. Cut J 10 presents the wearer with artificial legs applied and attired as in daily life.

UPPER INSTEP AND LEG AMPUTATIONS.—Cut J 11 shows an am-

putation of left foot at the instep and the right leg at the middle third. Artificial legs C 18 and E 17 were applied. Cut J 12



Cut J 13.



Cut J 14.

Cut J 15.

Cut J 16.

shows the wearer with the legs applied, engaging in his occupation as oysterman. This person has been employed in that industry for many years, and finds himself unhampered in his work.

Cut J 13 shows an amputation of the right foot at the instep and of the left leg immediately below the knee. The right foot was poorly nourished, and sensitive at the extremity, so much so as to completely prohibit any pressure. Cut J 14 illustrates the same case with D 21 and E 17 legs applied.

Both-Leg Amputations.—Cuts J 15 to J 21 illustrate amputations of both legs at various points between the knees and ankles, covering many lengths, characteristics of flaps, and situations of

Cut J 17.

Cut J 18.

cicatrices. Artificial legs suitable for any of these amputations, as shown in Cut J 21, are constructed on the plan of E 17. Cut J 22 shows the legs applied. The freedom with which wearers of legs for double amputations can get about, the naturalness with which they can sit, lie down, stand, walk, ascend elevations, ladders, ride bicycles, skate, and engage in almost any occupation are shown in Cuts J 22 to J 32.

Practical Results.—Persons wearing two artificial legs are so thoroughly in control of their means of locomotion that they go about much as other people. They readily resume their former occupations, no matter how arduous they may have been. Cut J 28 illustrates a case of double-leg amputations with artificial legs E 17 applied. A short time after obtaining the legs the wearer resumed his work of baggage master, lifting heavy trunks, carrying them about, and putting them on trains as one would

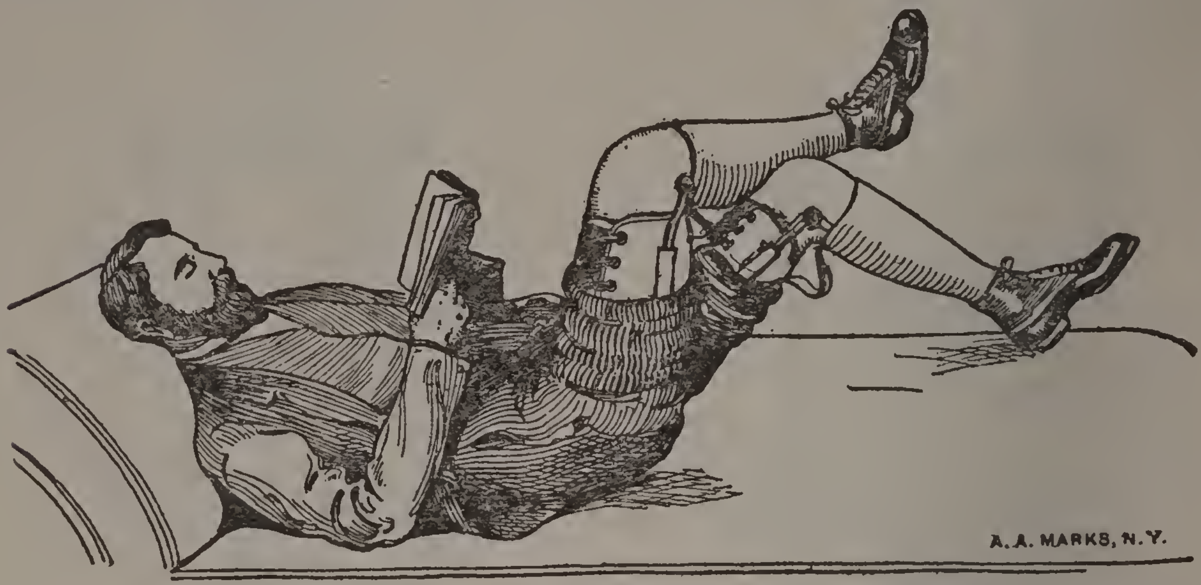
Cut J 19.

Cut J 20

Cut J 21.

Cut J 22.

do with natural legs. Cut J 29 portrays a railroad man with two artificial legs operating a switch. He dismounts, attends to the



Cut J 23.

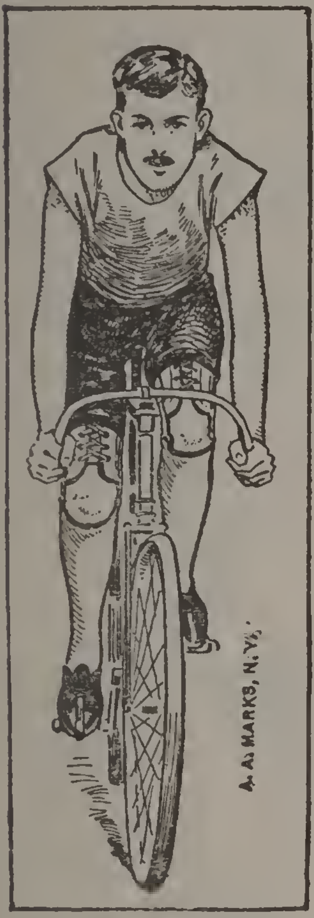
switch, frequently gets aboard while the train is in motion, and performs the work of a brakeman. He moves about quickly, steps over ties, and appears to be on as firm footing as if he had never

Cut J 24.

Cut J 25.

been deprived of nature's extremities. Cut J 30 shows a young man wearing two artificial legs, plan E 17; he is a conductor on a railroad, performing his duties in a thoroughly efficient manner.

He walks through the train when it is running at its greatest speed, collects tickets, and punches them. The cars jolt, pitch,

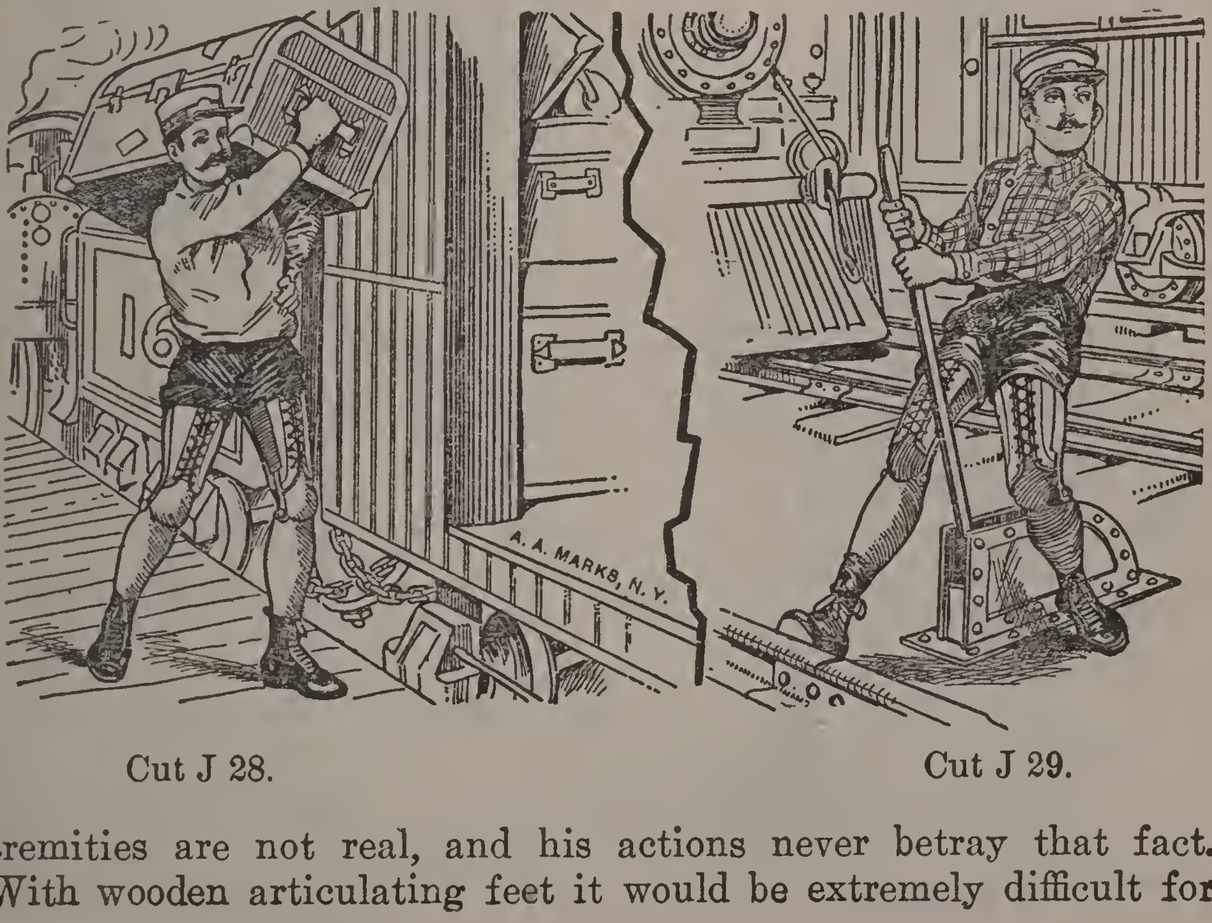


Cut J 26.

Cut J 27.

and sway, but he retains his balance with no perceptible effort or awkwardness.

At stations he alights, watches passengers, gives signals, and boards his train. It never occurs to anyone that his lower ex-



Cut J 28.

Cut J 29.

tremities are not real, and his actions never betray that fact. With wooden articulating feet it would be extremely difficult for

Cut J 30.

Cut J 31.

Cut J 32.

him to discharge such duties. He would feel unsafe, tottlish, and unsteady, but with rubber feet with spring mattress, rigidly attached, he has sound footing, and is capable of the most difficult feats of balancing.

Below-Knee and Knee-Joint Amputations.—Cut J 31 represents a case with both legs amputated; the right disjointed at the knee, and the left amputated three inches below the knee; Nos. E 17 and G 7 legs were applied. This man when in street

Cut J 33.

Cut J 34.

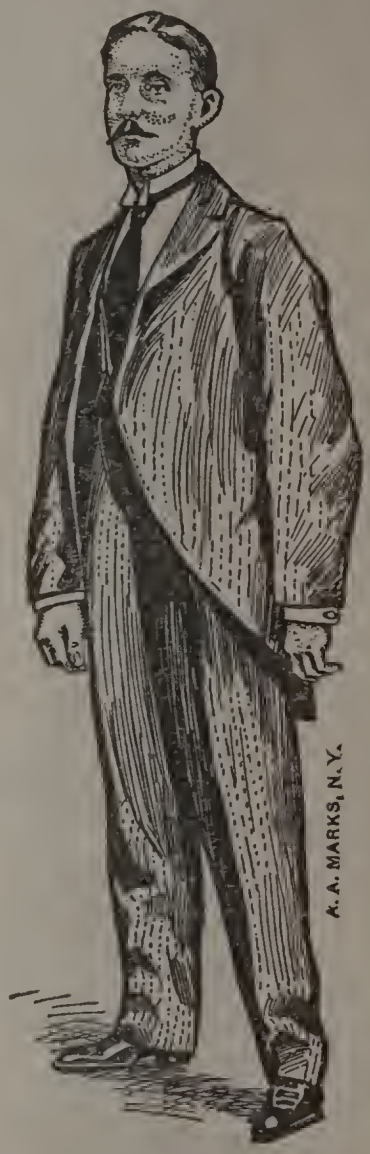
attire presents the appearance of a person with natural extremities. He walks naturally, and never consents to use a cane. He is a member of the Knights of Pythias, and takes pride in parading with his lodge. Cut J 32 shows him in his uniform.

Below-Knee and Above-Knee Amputations.—Cut J 33 represents amputations of both legs, the right below the knee and the left above the knee. Cut J 34 represents the same case, with E 17 and H 15 legs applied.

Cut J 35 shows a similar case; the right stump only five and one-half inches from the body, and the left one and one-half inches below the knee. E 17 was applied to the left side and H 15 to the right. The subject was restored to not only a natural appearance, but to the ability of walking without the aid of

canes or crutches, and so naturally that he has associated with persons for long periods without betraying the fact that his lower limbs were artificial. This young man has walked half a mile

Cut J 35.



Cut J 36.

in eight minutes without great effort. He works at the bench during the day, and the evenings are frequently spent at the billiard table. Cut J 36 shows him as he appears on his artificial legs, and in street attire.

Engaging in Former Pursuits.—We have many patrons wearing E 17 and H 15 artificial legs for double amputations who exhibit remarkable skill in performing feats that require sound footing.

Cut J 37 shows a person with two artificial legs as above described in a rowboat, illustrating the manner in which he can brace himself while pulling a strong oar.

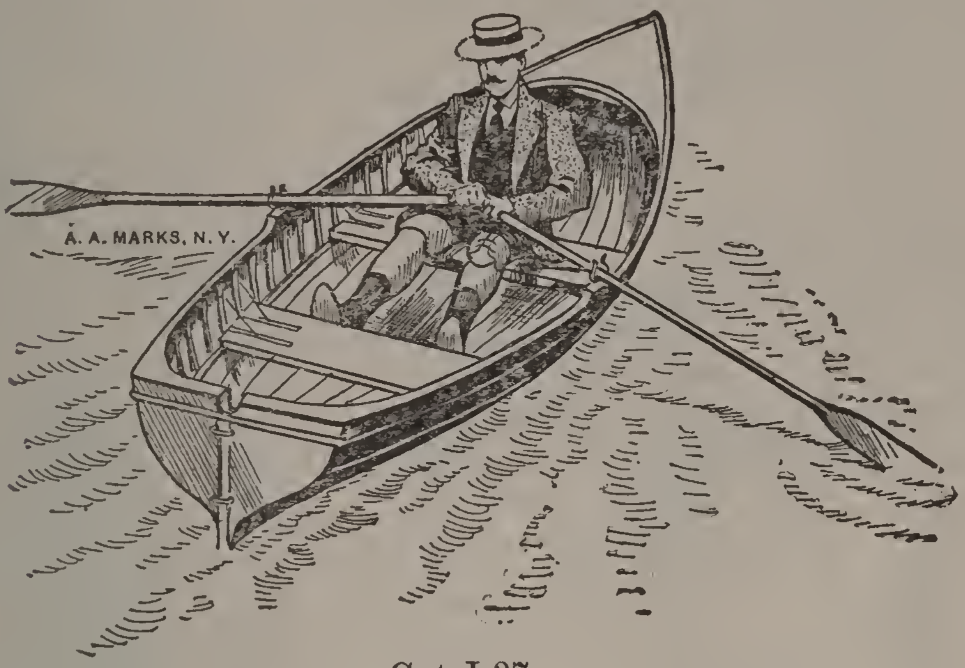
Cut J 38 shows another similarly equipped at the pool table, balancing himself on one foot while making a difficult shot.

Cut J 39 represents another with thigh and leg amputation, on a ladder, at a great distance from the ground; his footing is sound, his arms are free; he can hold a paint can in one hand, while he applies a brush with the other.

Cut J 40 represents another riding horseback, securely seated in the saddle, and feet in stirrups. The spring mattress rubber

feet are used in all of these cases, and sound and reliable footing are due to the excellent feature obtained by that means.

Both Legs and Both Arms Amputated.—Cut J 41 represents a case in which both legs and both hands were amputated. A



Cut J 37.

pair of artificial legs, and a pair of artificial arms were applied. The wearer became able to walk about in a very natural way; his artificial arms enabled him to feed himself at the table, write,

Cut J 38.

and perform such work as does not depend upon delicate finger movements and the sense of touch.

Both Legs Amputated Above the Knees.—No matter how extensively a person may be dismembered, prothetic science is ca-

pable of rescuing him from a life of helplessness. Only a brief period has elapsed since it was considered rash to apply a pair of artificial legs to a person who had both of his natural legs amputated above the knees. Attempts to substitute such a large portion of the body depending on short thigh stumps for support, resulted in failures, and until modern ideas were introduced and appropriate means for attachments were devised, failure followed

Cut J 39.

Cut J 40.

every effort. In 1864 the first pair of artificial legs was applied to double thigh amputations; the subject was a soldier of the Civil War. Although he was able to sit, stand, and walk on his artificial legs, the effort was so great that the wearer soon tired of them and abandoned their use, and became the occupant of a wheel-chair, dependent on his family.

In 1879 Mr. Marks made his second attempt, and succeeded admirably. The subject was a young man with two thigh stumps that reached nearly to the knees. This man soon acquired the art of balancing, and became so adept that he could walk about the house without the aid of canes or crutches, but when in the street he found it necessary to use a pair of canes. He has worn the pair of legs made in 1879 up to the present time. He is engaged in active business pursuits, and has reared and supported a large family.

Since the above date we have applied upwards of a hundred pairs of artificial legs to double thigh amputations. The manner

Cut J 41

Cut J 42.

Cut J 43.

Cut J 44.

in which these limbs were constructed, the way in which they were applied and adjusted, and the methods employed to give better control of the movements have varied according to the conditions

of each case. Each double thigh amputation presents problems of an individual character, and as there are seldom two alike,

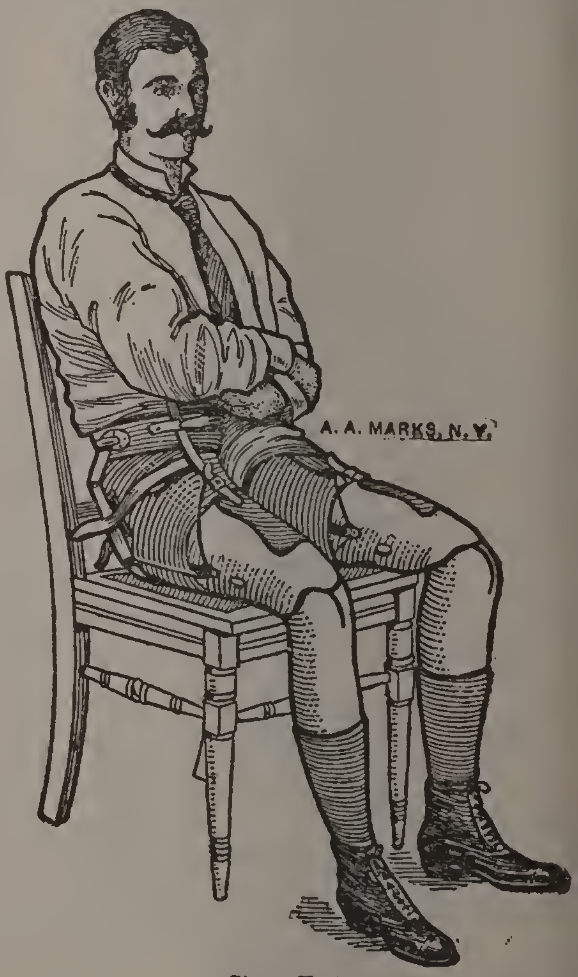
Cut J 45.

Cut J 46.

Cut J 47.

these problems must be solved by the manufacturer. The solution lies in the hanging of the legs, the method of suspension,

Cut J 48.



Cut J 49.

limiting the motion of the knees, and the absolute rigidity of the ankles. We cite a few cases.

Cut J 42 represents double thigh stumps, produced by amputations made to remove deformed parts. A pair of artificial legs of suitable construction was applied. The great lengths of these stumps gave such control over the artificial limbs that it was not necessary to apply hip joints or knee locks. The subject was a musician. In a brief time he was able to walk naturally, resuming his profession, and now has a national reputation as a clarionetist. He walks on the stage, plays the instrument, acknowledges encores, and retires in the usual stage manner.

Cut J 43 represents a double knee joint amputation. A pair of suitable artificial legs are shown in the same cut. Cut J 44

Cut J 50.

Cut J 51.

shows the artificial legs applied, and the wearer in the act of walking.

Cut J 45 represents a child who had both legs amputated above the knees on account of a railroad accident. A pair of artificial legs with knee locks was applied to advantage. The child has, for a number of years, walked on the artificial legs very satisfactorily. He has been enabled to walk to school and indulge in childish pastimes. The manner in which the artificial legs were held in place is shown in Cut J 46, front view, and Cut J 47, rear view.

Cut J 48 represents a double thigh amputation, the result of a railroad accident. Cut J 49 shows the application of a pair of artificial legs with the wearer seated. Cut J 50 represents the same person standing, and in Cut J 51 he is attired as he appears when walking. This case is one of the most remarkable on record. The stumps only extended to about the middle of the thighs, but through the energy of the wearer and the efficiency of the artificial legs, he was able, in a brief time, to walk about in a very natural way, and go up and down stairs; he uses no canes about the house. The artificial legs H 15 were applied with hip joints and automatic knee locks, but after a brief time the wearer dispensed with the locks and found that he could control the artificial knee joints without danger of treacherous flexing. Under earlier systems this case would have been considered hopeless, and the thought of applying artificial limbs would never have been entertained.

CHAPTER XI

ARTIFICIAL FEET AND LEGS FOR DEFORMITIES, PARALYSIS, EXCISIONS, ARRESTED GROWTH, SHORTENED LEGS, ETC.

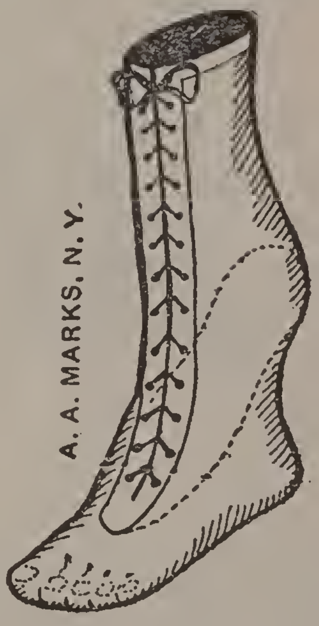
Deformities of the feet or legs may be due to causes congenital, traumatic, or pathological. Appliances for such cases frequently partake of the character of artificial legs and call for the skill of the prothetician.

No matter how greatly distorted, deformed, or weakened one or both legs may be, there is reasonable hope that some appliance can be used that will aid locomotion, hide the affected parts, and restore a fair degree of symmetry to the person.

Short Leg.—The most frequent leg abnormity is that of shortening, due to hip-joint troubles in infancy, or to paralysis.

Cut K 1.

Cut K 2.



Cut K 3.

Cut K 1 represents a case of shortened leg caused by hip dislocation. The front of the foot is dropped downwardly to enable the subject to walk on the ball of his foot.

Talipes-equinus.—Cut K 2 represents a case of talipes-equinus, leg shortened from one to three or more inches, due to paralysis. The ankle joints in K 1 and K 2 were normally strong and the knees and hips under thorough control. Cut K 3 shows an appliance suitable for either of the above cases. It is termed an extension foot, and is constructed from a wooden block, the upper surface shaped to receive the sole of the affected foot, with the front part dropped to a convenient angle (see dotted line). The

under surface of the block is connected with the lower part of a rubber foot. The entire structure is covered with suitable leather, the upper of which runs well up on the leg, incasing the entire foot and ankle. Cut K 4 is a shoe, to be drawn over the foot and appliance. It is usually a part of the mate of the

Cut K 4. Cut K 5. Cut K 6.

shoe worn on the opposite foot, the quarter having been removed and a larger one put on having the shape and dimensions required to fit properly. This alteration in the shoe is easily made, and can be done by any shoemaker at slight expense. The extension, when complete and covered by a shoe, is shown in cut K 5. Cut K 6 shows it covered with the trousers. Persons with these appliances walk much better than they do with the old style, thick sole and high-heel shoe. They present a better appearance and are far more comfortable.

Talipes with Lateral Weakness.—Cut K 7 represents a shortened leg with talipes and loss of control over the ankle joint, there being a strong tendency for the ankle to give way sidewise. A suitable appliance is shown in the same cut. It is constructed of wood, carved from a block with naturally curved grains, or made of aluminum, as conditions require. It receives the leg and foot in a comfortable way and holds them firmly in place. The heel and toes are of rubber. Cut K 8 represents the case with appliance in place and wearer walking. In cases of atrophy of the calf, which frequently accompanies these cases, the leg structure can be carved to approximate the contours and dimensions of the sound leg. There will scarcely be an appreciable increase in weight.

Toe Support.—An appliance of above type is helpful in holding the foot in correct position, and on account of the rigidity of the ankle the wearer obtains toe support that enables him to rise on the ball of the foot when walking. This produces a natural

step, avoids limping, and enables the wearer to go up and down stairs and alight on elevations. It also aids him in balancing, and, as the point of resistance at the ball of the foot is in advance of the knee joint, the tendency of the knee to flex is counteracted; this adds materially to the efficiency of the apparatus, giving the wearer a feeling of confidence and security. A person

Cut K 7.

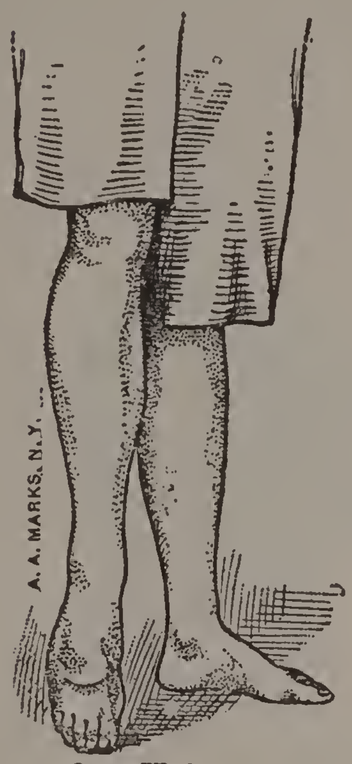
Cut K 8.

with a paralyzed leg, using ordinary braces, usually finds it necessary to press his hand against his knee joint when his weight is on the affected leg. He does this to keep the knee from flexing and precipitating a fall, but with the appliance just described firmness of the knee joint is obtained by phalangeal support in the foot, and the wearer is not dependent on pressure placed in his knee joint, or on attachments going above the knee.

Cut K 9 shows a shortened leg with hip and knee joints under control; the ankle suffered a loss of strength and required supporting.

Cut K 10 represents a leg shortened by hip-joint trouble in youth, producing a deficiency in length of about ten inches; the knee and hip joints are under control and the bottom of the foot is capable of bearing weight. Cut K 11 represents a leg, designed for each of the above cases, the natural foot is dropped to the greatest angle that can be tolerated and made to rest on an

inclined surface at the required distance from the floor. The leg is incased by a socket made of wood and leather. Cut K 12



Cut K 9.

Cut K 10.

Cut K 11.

represents the appliance in place, and Cut K 13 shows the patient properly and neatly attired.

Congenital Deformity.—Cuts K 14 and 15 illustrate the front and side views of a case of congenital deformity. The foot

Cut K 12.

Cut K 13.

appears to be attached to the external side of the tibia immediately under the fibula. Weight can be borne on the sole only when the foot is held in position. Cut K 16 gives a side view of

a suitable appliance constructed substantially the same as K 11. The displaced foot is held firmly in correct position and the wearer walks helpfully and quite naturally.

Talipes-varus.—Cut K 17 represents a case of talipes varus, resulting from paralysis—the knee joint being involved. A suit-

Cut K 14.

Cut K 15.

Cut K 16.

able appliance is shown in the same cut. Cut K 18 shows appliance in place and the wearer seated; with this appliance the wearer is enabled to walk acceptably.

Leg Deformities.—Cut K 19 represents a deformed right leg. From the knee down, the leg is diminutive, terminating in a

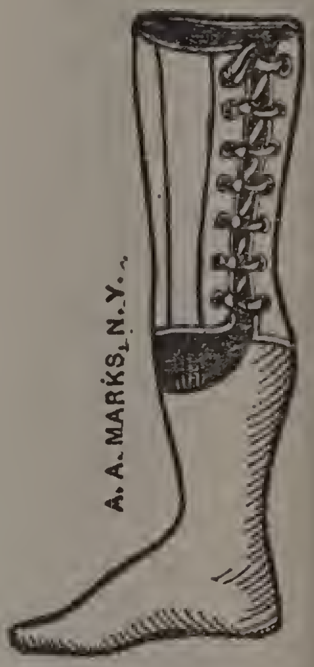
Cut K 17.

Cut K 18.

miniature foot, inclined inwardly and backwardly; the shortening due to arrested development amounts to eight inches. Cut K 20 shows a suitable leg. The deformed leg, from the knee down, is

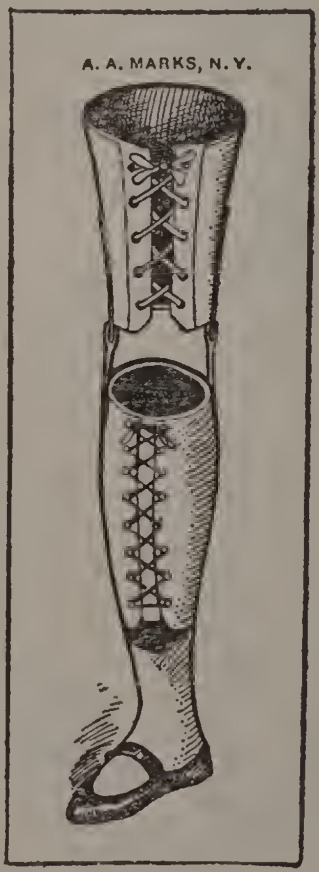
received into the socket of the artificial leg and held there comfortably. A rubber foot, with spring mattress placed at the required distance to restore length, fully equipped the child with means of locomotion.

Cut K 19.

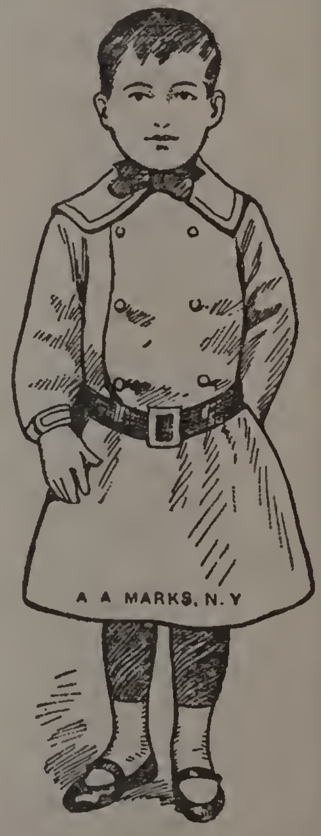


Cut K 20.

Cut K 21.



Cut K 22.



Cut K 23.

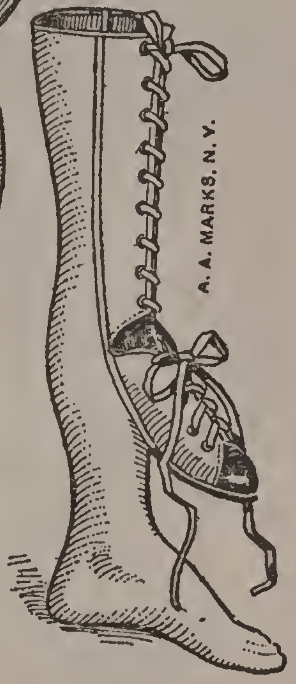
Cut K 21 represents a right-leg deformity; hip, thigh, and knee under normal conditions; the leg from the knee down undeveloped, foot very small, terminating in a great toe growing from

the internal side. Cut K 22 shows an artificial leg devised for the case. The deformed leg is received in the socket and laced. The toe is provided with a protecting pocket, the weight is taken partly on the plantar surface of the miniature foot and partly about the leg below the knee and about the thigh. When first applied the leg only reached to the knee, but it was found that there was a weakness in the knee, with a tendency to abduct; knee joints and thigh support were added, which prevented yielding to lateral weakness. Cut K 23 shows the leg applied and the child standing. Since the application of the appliance the child has

Cut K 24.

Cut K 25.

Cut K 26.



Cut K 27.

grown rapidly in stature and weight, well developed, strong and healthy.

Cut K 24 represents a congenital deformity of the right leg, consisting of a malformed foot, miniature leg, and abnormal relations of tibia and fibula. The tibia extends to the ankle, without connecting with the foot. The fibula connects with the foot but not with the leg, the two bones held in position by cartilage. When standing on the right foot the bones would slide by each other over an inch; there was also lateral weakness, rendering walking impossible without assistance. Cut K 25 represents an appliance constructed for the case, made of aluminum formed to receive the foot and leg in a comfortable way, terminating with a rubber foot. The weight, when standing or walking, was placed on the internal sloping surface of the tibia, immediately below the knee. The socket held the tibia and fibula in position. This appliance has been used for many years, enabling the wearer to engage in arduous labors, and capable of walking great distances without fatigue.

Cut K 26 represents a shortened and malformed leg. The shortening appears to have been located wholly in the leg between

the knee and ankle. Cut K 27 represents a suitable leg. It is constructed to receive and hold the deformed member firmly in place. A rubber foot, placed under the foot-rest, gives the required length. The motion in the ankle made it possible to drop the toe to a concealable angle. Although the apparatus had the appearance of a double foot, there was no difficulty in concealing the deformity by the trousers.

Cut K 28 illustrates a deformity of the right leg. The hip and thigh are normal and an undersized foot appears to have grown

Cut K 28. Cut K 29. Cut K 30. Cut K 31.

immediately from the knee. The patient was able to flex and extend the foot the same as a leg, or, in other words, he had an articulation at the junction of the thigh and the foot, the tibial section being absent. Cut K 29 represents an artificial leg devised for the case. It is similar in its general construction to that represented in Cut E 17. The socket of the leg is excavated to receive the foot, the knee joints and thigh supporter give the foot control over the artificial part.

Cut K 30 represents a deformed left leg. From the knee down it was misshapen, contracted, and distorted. Cut K 31 represents a suitable artificial leg applied. The deformed parts were placed well up and out of the way, concealed by the dress.

Cut K 32 represents a deformed lower right leg, very similar to the one just described. The knee, however, admitted of more flexion, and the artificial leg was made to receive the thigh and deformed part in one socket and was held in place by means of a leather sheath passing from the rear and lacing to the front line of the thigh, as shown in Cut K 33.

Infantile Paralysis.—Cut K 34 represents an undeveloped left

leg, the entire limb considerably atrophied and the joints weak, caused by infantile paralysis. Cut K 35 represents an artificial leg especially designed for the case. The deformed leg is received in the socket and laced in place and the foot dropped to the greatest angle of toleration. The thigh piece incases the thigh

Cut K 32.

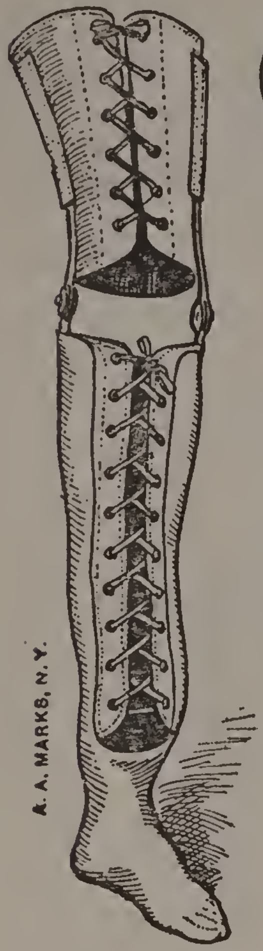
Cut K 33.

Cut K 34.

and the joints support the knee; a rubber foot is placed at the extremity. Cut K 36 presents a side view of a similar appliance with a knee lock, which is necessary in cases of loss of control in the joints.

Cut K 37 represents a deformity of the right leg; the hip, thigh, and knee normal and healthy, but the leg and foot diminutive in size, with foot rotated outwardly. Cut K 38 represents an artificial limb especially devised for the case. The undeveloped leg is received into the socket, the foot protrudes through an aperture on the external side, the knee joints and thigh piece, placed above the knee, give support and strength about the thigh. A rubber foot, with spring mattress at the lower extremity, completes the apparatus and gives the required support.

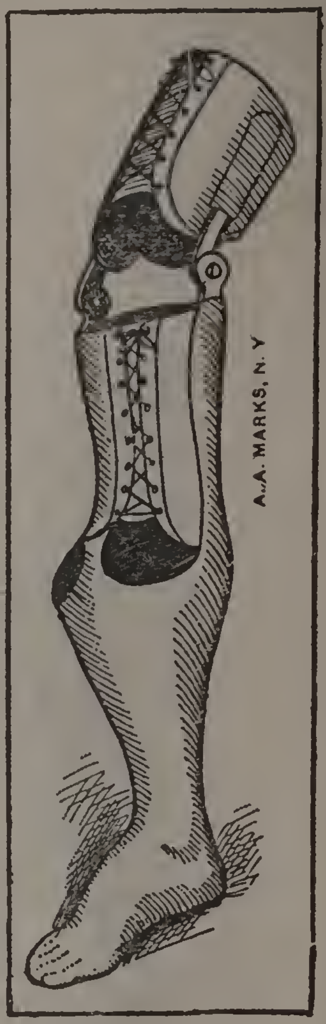
Obstructed Growth.—Cuts K 39 and K 40 represent cases of obstructed growth, the hip joints normal, the thighs possessing nearly the proper lengths, terminating in short and misshapen legs. Cut K 41 represents a leg suitable for either case. Both these persons were enabled to walk nearly as well as if normal conditions existed. A slight enlargement of the trousers a little above the knee (necessary to accommodate the deformed leg) is the only noticeable difference in the two sides, and that difference so slight as to be observed only by the critical eye.



Cut K 35.

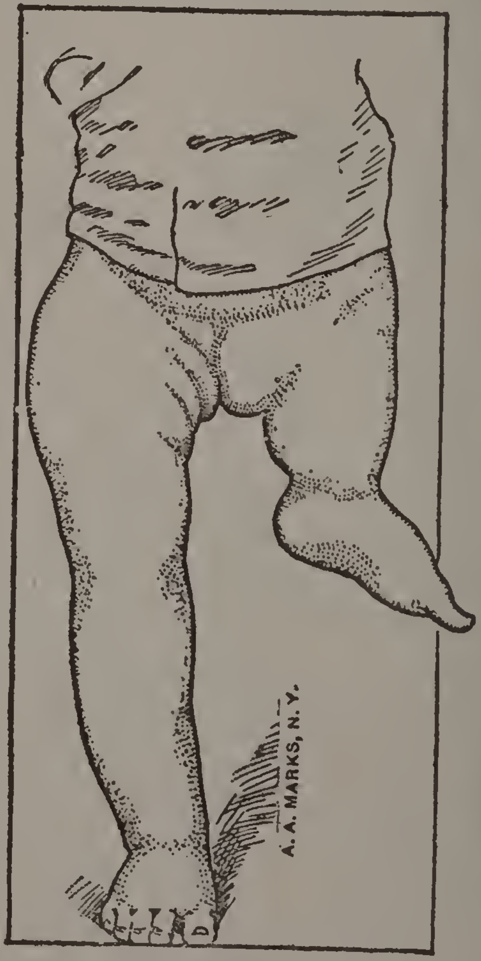
Cut K 36.

Cut K 37.



Cut K 38.

Cut K 39.



Cut K 40.

Cut K 41.

Cut K 42 represents a deformity consisting of an undeveloped femur and partially developed leg, the knee joint located very

close to the hip. A suitable artificial leg is shown in same cut. The wearer walks so perfectly with this leg that his deformity is absolutely concealed.

Both Legs Deformed.—Cut K 43 represents a deformity, both legs atrophied, talipes-varus, feet abnormally large. Amputation of both feet at the ankle joint after the Symes method was advised. This was done and the patient obtained a pair of legs, on which he walks and performs labor acceptably. Cuts K 44 and K 45 represent front and side views of a deformity of

Cut K 42.

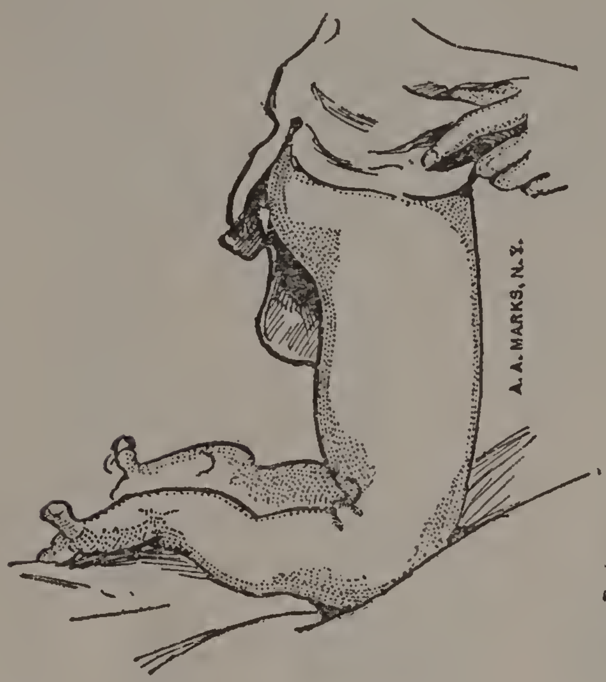
Cut K 43.

both feet. From the hips to a little below the calves normal conditions were present; at about the calves there were false joints supplementary to the knee and ankle articulations. These false joints were under poor control, not sufficient to hold the feet in proper position. We advised the amputation of both limbs through the false joints. This was done, and the child had two excellent tibial stumps on which artificial legs, style E 17, were applied and worn with comfort and efficiency.

Cut K 46 represents a case of amputation of right leg and talipes-varus in the left. A suitable artificial leg for the right side and a helpful appliance for the left are shown in the same cut; Cut K 47 shows the limbs applied and the wearer standing erect. The disposition of the leg to rotate inwardly was controlled

by the appliance and the leg was compelled to operate in the line of progress.

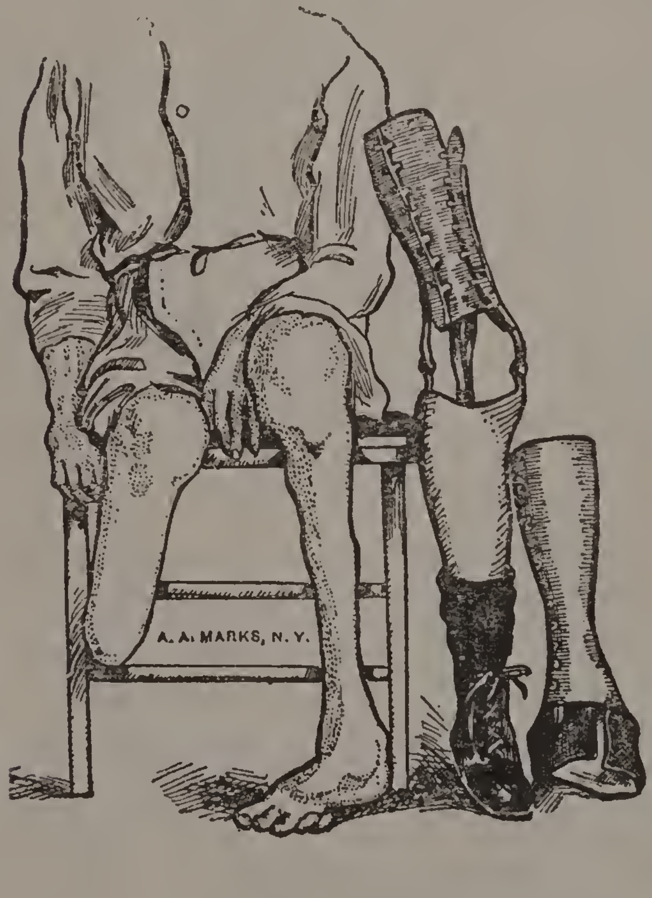
Cuts K 48 and K 49 represent front and side views of a case



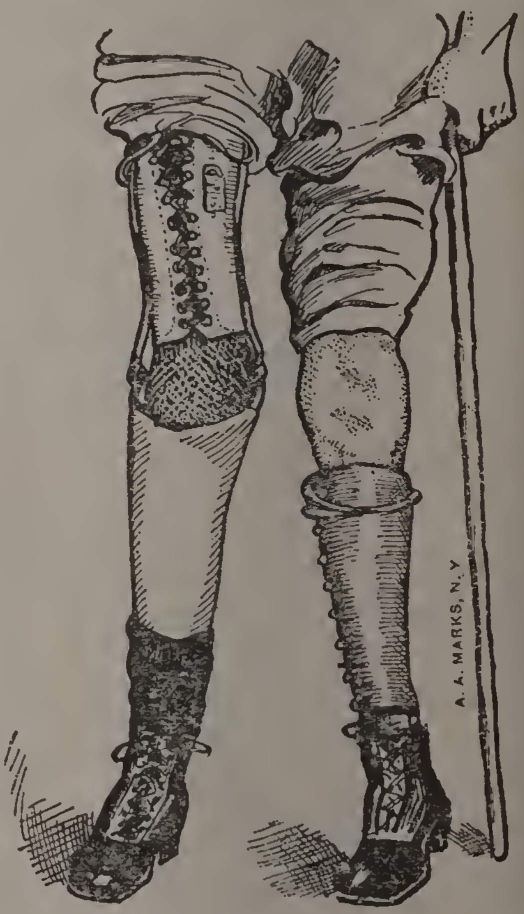
Cut K 44.

Cut K 45.

of congenital deformity of both legs, rendering walking very difficult and more largely dependent upon crutches than on feet. We advised the amputation of both legs at the calves. The subject



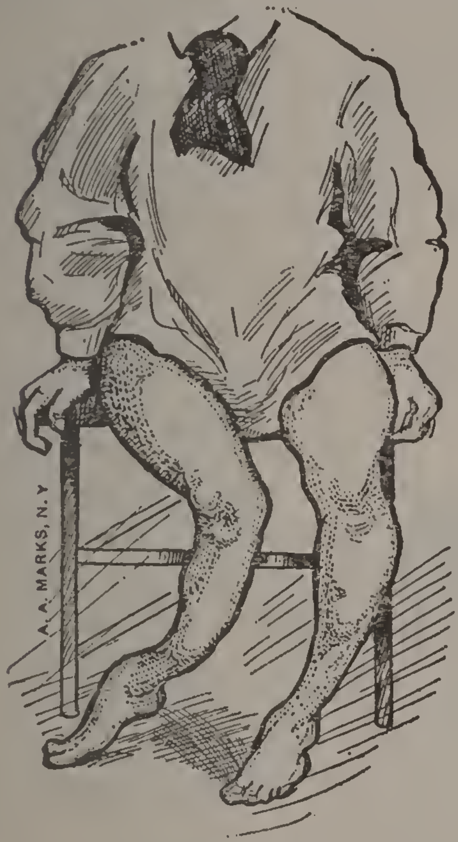
Cut K 46.



Cut K 47.

submitted to the amputation of the right leg, but decided to retain his left, which appeared to have more sustaining power. Cut K 50 represents the case after the amputation of the right leg, and

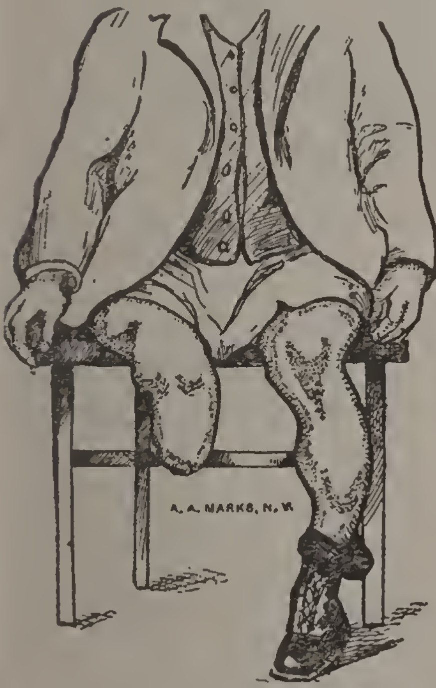
Cut K 51 represents him with the artificial leg applied, while Cut K 52 shows him dressed. The condition of the wearer was greatly improved by the removal of the right leg and the application of



Cut K 48.

Cut K 49.

an artificial one. The improvement would have been carried further if he had submitted to a similar operation on the left side, thereby obviating the outward curve of the lower leg, which



Cut K 50.

Cut K 51.

Cut K 52.

is conspicuous even when covered with trousers. Cut K 53 represents a case of paralysis of the right leg, knee slightly flexed. Cut K 54 represents the same with one of our instruments

applied; wearer seated. It was constructed with knee joint, provided with automatic lock, preventing flexing with the weight directly over the leg, permitting flexion when the wearer is seated. The foot is held in proper position for standing and prevented from flexing treacherously when walking.

Cut K 55 represents congenital deformities of both legs; branches grew from the inner surfaces of both femurs. That on the right thigh was ten inches in length, on the left not more than two. The knee joints were on the inner surfaces of the ends of

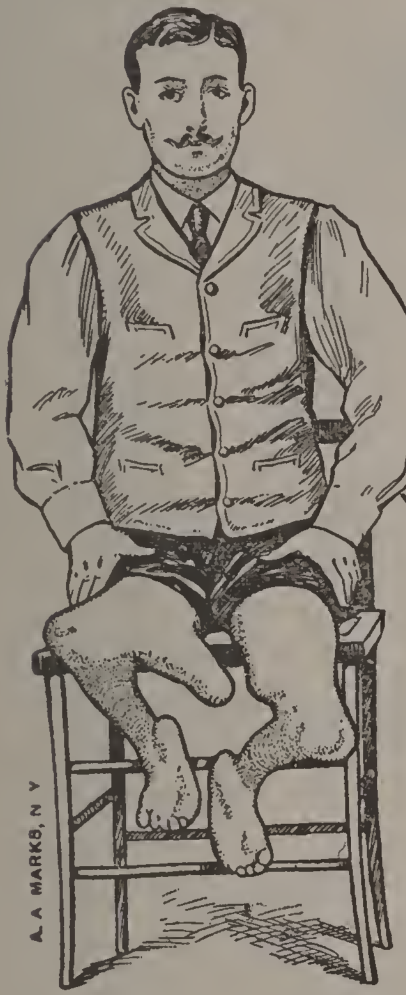
Cut K 53.

Cut K 54.

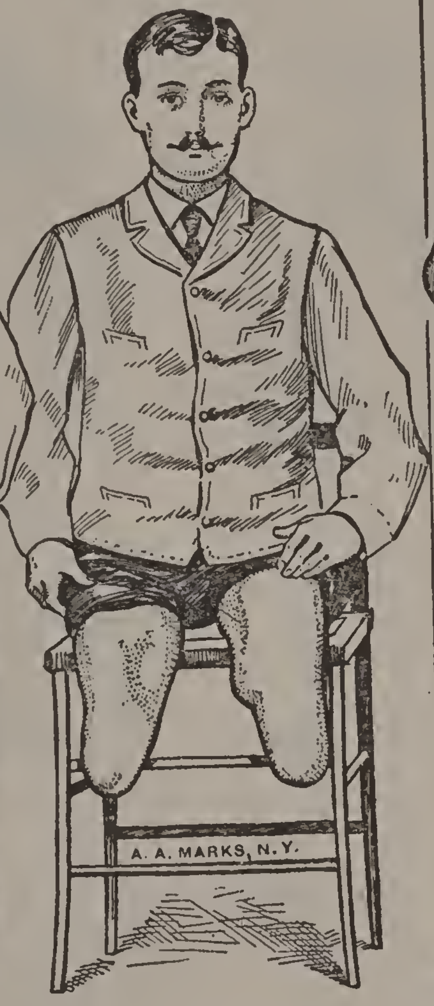
the femurs, feet everted and badly formed. In boyhood, locomotion was obtained by moving about on his haunches; later he walked with the aid of crutches, bearing on the ends of his femurs and dragging the deformed legs. For twenty-five years he submitted to these awkward and unsightly means for getting about. His attention was finally called to artificial limbs, and upon consulting well-informed persons he found that he could improve his condition by having the useless parts of the legs removed and artificial ones applied. We indicated points at which amputations could be performed to advantage. After the operations his stumps presented the appearances shown in Cut K 56. We applied a pair of artificial legs, constructed on the plan of those represented in Cut G 8. When dressed, this man had the appear-

ance of a person with natural and well-formed legs. Cut K 57 is taken from a photograph, showing him as he appears in ordinary life.

Cut K 58 represents a case of arrested development. The child was well formed from the knees up, but from the knees down his deformity was pronounced and of a character to render walking



Cut K 55.



Cut K 56.

Cut K 57.

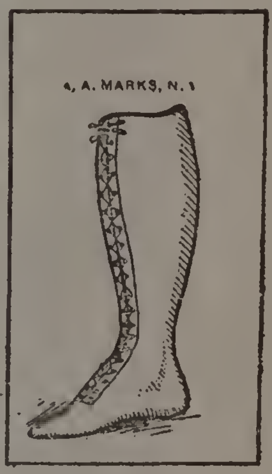
impossible. The child managed to get about rather awkwardly with crutches, permitting but little weight to come on his feet. As the joints in the ankles and knees were flexible, and as the feet were small, we found that we could incase the entire legs, provide knee motion, and place rubber feet at suitable distances below the deformed ones. This was done, and the lad was brought to his proper height, making a presentable appearance and walking in a very acceptable way, without the aid of crutches. He controlled the artificial knee joints by means of his feet and had little or no difficulty in balancing, walking, sitting, rising, ascending or descending steps. Attention was given to ornamentation, and when dressed his deformity was entirely concealed, as shown in Cut K 59.

Drop Foot.—The drop foot, resulting from paralysis or arrested development, is a frequent infirmity. Usually the leg is of normal length, the knee joints contracted and weak, with loss of control at the ankles and lateral weakness or a tendency for the foot to bend sidewise, either varus or valgus. The only practical manner in which a leg of this sort can be rendered useful is by fixing the ankle joint artificially, thus providing a resistance at the ball of the foot, the concomitant for balancing, maintaining height when walking and serving as a lever for propulsion, and as a counteracting influence to the tendency of the knee to flex. Cut K 60 represents a case of this kind. Cut K 61 represents the

Cut K 58.

Cut K 59.

Cut K 60.



Cut K 61.

appliance we have devised for such. It is practically a form of splint, cast of aluminum to the shape of the leg and foot. The metal is carried under the entire foot, holding it at a proper angle for walking. The front is provided with leather, arranged for lacing. This appliance holds the ankle joint firmly and provides support at the ball of the foot, which is so far in advance of the center of motion of the knee that it prevents the knee from flexing when the weight of the wearer is directly over the foot. Persons with these appliances walk rapidly and quite naturally, seldom requiring any attachments above the knees.

In connection with appliances of this type for paralyzed lower extremities we may quote from the Cincinnati *Lancet-Clinic* of October 9, 1897. A prominent physician read a paper before the academy regarding the treatment of his own paralyzed leg:

"An illustrated catalogue fell into my hands, in which was pictured, among artificial legs, etc., an apparatus made of aluminum, splint-like in character, with a rubber cushion under the foot to compensate for shortening. It was made for a case of congenital dislocation of the ankle. The more I studied it, the

more it appealed to me that such an apparatus could be made for my own comfort. I had reached a period when I was considering amputation and the substitution of an artificial leg for my paralyzed one. Impressed with the illustration of this apparatus, I consulted a friend upon the subject. He was as much impressed with it as I was, but advised me to obtain the opinion of our surgical friends. They were likewise impressed with it and advised that I try the conservative measure first before I resort to the radical one. I went to New York and consulted the maker. After studying my deformity for a few minutes, he stated that an apparatus could be constructed that would materially improve my condition. The appliance was made and worn for four years. But those four years! How can I describe them? Pen and words fail me. It was like a beautiful oasis in a dreary desert of years of suffering. In connection with my deformity there was a weakness of the abductor muscles, which permits of a rotation outwardly of the thigh. This has been overcome by rubber abductor muscles. The one fastened to the outer side of the apparatus crossed the front part of the right thigh, crossing to the left side of the trunk, and is inserted into the harness. The one attached to the inner side of apparatus is inserted over the right posterior part of the harness, which is suspended from the left shoulder.

"Who are my benefactors? Who are those who have given to me the comfort of four years' duration, with a bright future of many more? And, within such a short period, free from pain, caused the twenty odd years of suffering to disappear in the dim and misty past?

"Oh, for a trumpet of such power to herald to the world their name, that those who are needy may seek them! But instead, in gratitude do I raise my feeble voice and wish the cup brimful of happiness for the firm of A. A. Marks, New York City.

"'By thy deeds shalt thou be known!'"

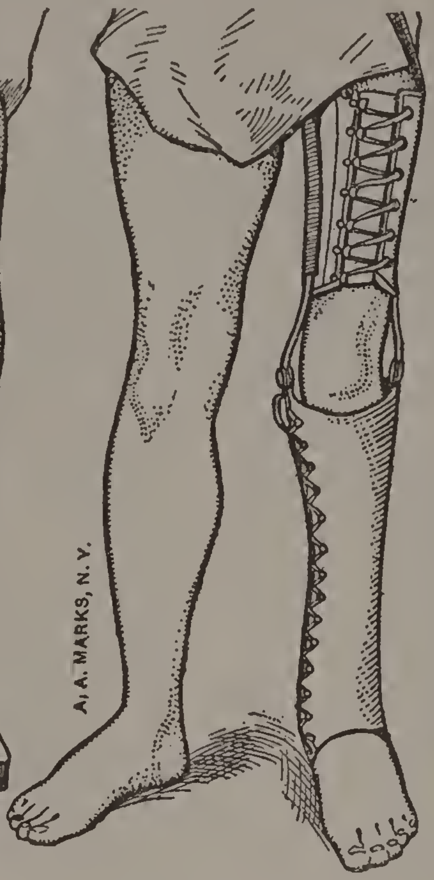
Knee Joints Locked.—Shortened and paralyzed legs are frequently accompanied with total loss of the power of extension and flexion in the knee joints. In such cases the mechanism of the artificial knee joints is provided with locks that hold the knees rigid when standing or walking. The joints are capable of being unlocked to admit of flexion when sitting.

Cut K 62 represents a shortened, atrophied, paralyzed leg. Cuts K 63 and K 64 show the same case, with apparatus in place. The apparatus consists of a socket that incases the leg, knee joints with locks that support the knee, thigh piece that takes the support about the thigh, and a rubber foot placed under the deformed natural foot in order to obtain the proper length.

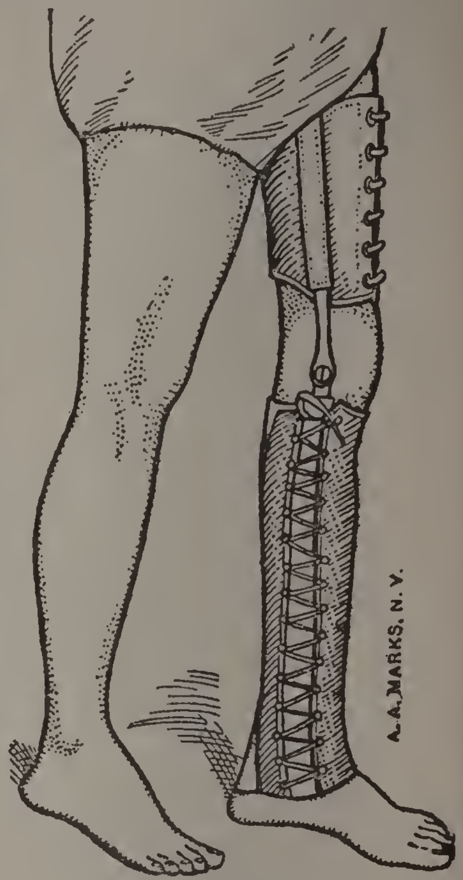
Limited Knee Motions.—Cut K 65 represents a shortened leg with limited motion in the knee, the knee capable of flexion, but incapable of extension beyond the angle represented in the cut; the hip normal and the bottom of the foot capable of enduring pressure. Cut K 66 represents an artificial leg suitable for the case. It is

made with a wooden socket, fitted to receive the leg. A comfortable shelf is provided for the foot to rest upon. Knee joints with pawl and

Cut K 62.



Cut K 63.



Cut K 64.

rack and thigh piece incasing the thigh are provided. The pawls at the knee joints are operated by levers which pass up the rear of

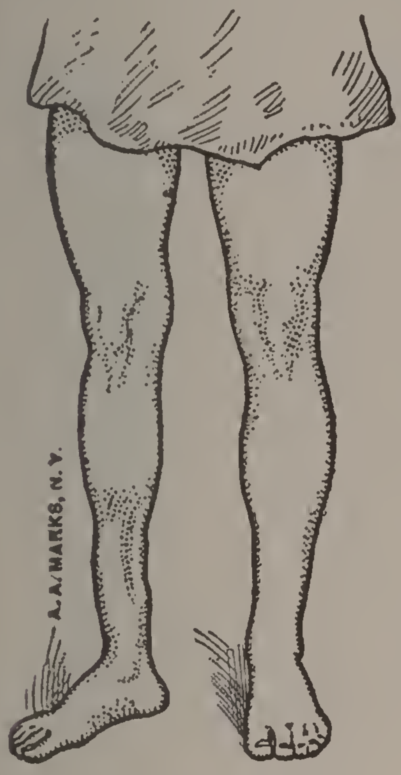
Cut K 65.

Cut K 66.

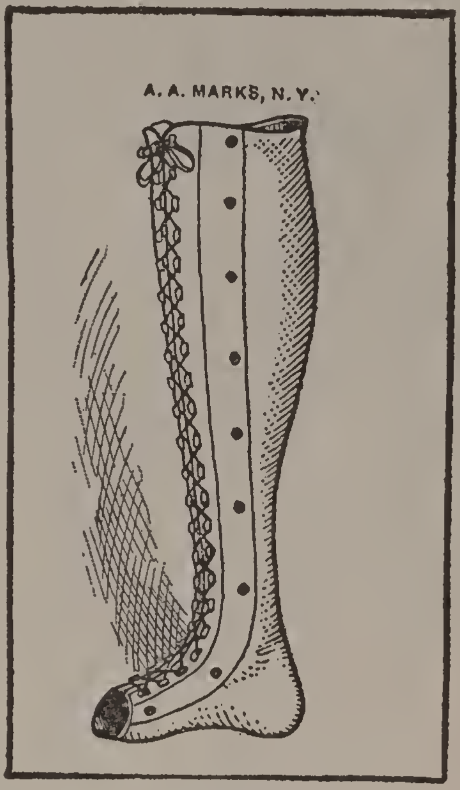
Cut K 67.

the thigh. When standing or walking, the leg is brought to the point of greatest extension, the pawls automatically drop into the rack and make the leg immovable at the knee. The moment the

wearer is seated, the lever will rest on the chair and force the pawls out of their racks, allowing the knee to flex (see Cut K 67). By this means the wearer is able to walk safely with rigid knee



Cut K 68.



Cut K 69.

and bend the knee when sitting. The apparatus has a rubber foot with spring mattress placed at the proper distance below the paralyzed one.

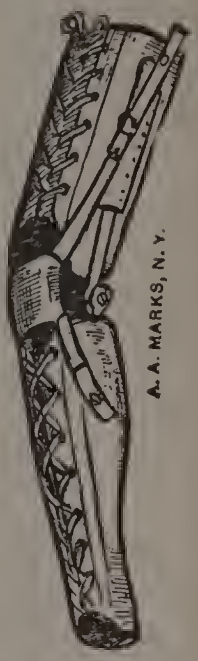
Ununited Fractures.—Cut K 68 represents an ununited fracture of the tibia and fibula at a point a little above the ankle joint. Usually, in cases of this kind, it is deemed advisable to amputate, the wisdom of which we do not question. Occasionally, however, and particularly in the case here illustrated, the horror of the knife kept the patient from submitting to that alternative, and he came to us for help with a dangling foot, under no control whatever. He was young and in good health, and cherished the hope that if the fractured parts were held firmly in juxtaposition, nature might eventually, in her mysterious way, bring about a union. We constructed an aluminum socket, incasing the leg from the knee down and the entire foot, fixing the ankle. This appliance, shown in Cut K 69, was fitted when the tibia and fibula were in apposition. Weight was communicated from the bottom of the appliance to the leg immediately below the knee. No weight whatever was brought on the foot and no strains permitted to cause the bones to move out of the places in which they were held. The appliance has been worn advantageously for a number of years. The manner in which the wearer gets about, walks, and attends to his vocation is exceedingly gratifying.

Cut K 70 represents an ununited fracture of the right tibia, due to gunshot wound. All efforts to bring about a union failed. The fibula was not injured, but in consequence of failure of union in

the tibia it was obliged to do the work of both bones. Being overtaxed, it gradually yielded and became curved, as shown in the cut. The dark spot immediately below the patella represents a deeply indented scar at the point of fracture. Cut K 71 repre-

Cut K 70.

Cut K 71.



Cut K 72.

sents a suitable brace for the case, made of wood and leather. A block of wood is excavated to receive the fractured member in its most comfortable position. The leg, when placed in this splint-like appliance, is held firmly by means of lacing. As the injury shortened the leg about one inch, a block of suitable thickness was hinged to the lower extremity of the splint on which the foot rested. Owing to the proximity of the fracture to the knee articulation, it was impossible to construct the brace that would admit of knee motion. The appliance has done its work for a great many years with great satisfaction to the wearer.

Fractured Knee Caps, etc.—Resections of knee joints, fractures of knee caps, weakening of the patella ligaments, in fact any ailment that lessens or destroys control over the knee articulation is greatly benefited by appliances similar to that represented in Cut K 72. The socket below the joint is made of wood, with a leather front capable of being laced. The upper socket is made entirely of leather. The knee joints are made with stops, so that extension cannot be made beyond the proper limit. In cases of partly flexed knees, due to knee-joint disease, this appliance can be used to advantage, requiring knee locks in addition.

CHAPTER XII

FACTS FOR CONSIDERATION

Wooden Feet Substituted by Rubber Ones.—Artificial legs, manufactured with wooden articulating feet, are more or less troublesome and expensive to keep in order, and are deficient in supplying the requisite propulsive power in walking, it is therefore often deemed advisable to remove them and substitute rubber ones. We have devised methods by which this can be done, whether the legs be constructed of wood, leather, or metal. Our charge is $20.00 in each case. We guarantee the attachment to be strong and lasting. A foot of any size or shape to meet the wishes of the wearer can be put on, and the leg can be made longer or shorter, as may be desired.

A Way to Test the Rubber Foot.—The attachment of a rubber foot to an old artificial leg is often done to test its merits. It gives an admirable opportunity for the wearer to try the rubber foot and ascertain for himself the advantages it has over those he has worn.

An experiment of this sort can only be successful when the socket of the old artificial leg fits correctly; if it does not, the leg cannot be worn comfortably and satisfactorily, no matter what kind of a foot it may have.

A cabinet maker, carpenter, or other mechanic, be his skill in his own line what it may, should not be expected to connect a rubber foot to an artificial leg with assurance of satisfactory results. The alignment, the set of the foot, the angle at which it should be placed relative to the shaft, are important factors and must be thoroughly understood and their relations to each other comprehended, or the results will be disappointing. This knowledge can only come from experience; we therefore dissuade persons from buying rubber feet and having them put on their artificial legs by home mechanics. We therefore insist that artificial legs be sent to us for such work, and for which we make no extra charge.

Ease and comfort in wearing an artificial leg depend almost entirely upon the manner in which the socket receives the stump. No matter how correctly the leg may be constructed, or with what nicety the parts operate, it is worthless if it causes pain, abrades the stump, or interferes with the circulation.

Fitting—an Art.—The fitting of an artificial leg is an art, only acquired by thought and the experience of years. A thorough knowledge of the anatomy of the stump, the effects of pressure

on various points, the manner in which interference with the circulation or the displacement of tissues on the stump can be obviated must be understood, or the fitter is not qualified to be intrusted with such work.

There are a great many artificial limb manufacturers in the world, but there are a very few fitters.

Only One Way to Fit.—There is but one way in which a leg can be made to fit correctly, and that is to excavate a block of wood until it has the proper size and shape to receive the stump, so that pressure will be placed where it can be endured, there must be absolute freedom from contact on the blood vessels and exposed nerve areas.

A leg that puts pressure uniformly on the stump is not a comfortable one to wear, for there are many places on every stump that cannot bear any pressure whatever. There are other places that can endure any amount of pressure; a socket to be comfortable must, therefore, be made so as to apply pressure only where it can be endured.

When Plaster Casts are Useless.—A plaster cast of a stump and a plaster cast of the inside of a socket that fits the stump correctly are no more alike than the last on which the shoe is built is like the foot on which the shoe is worn. It is absurd to assume that a serviceable, comfortable socket can be made by molding a plastic material, such as leather, felt, or wax, on the cast of a stump or by molding it on the stump itself. Sockets so made are always irritating and cause pain and suffering. It is likewise an error to assume that a block of wood can be cut out to the contours of a plaster cast of a stump and fit the stump comfortably. If it were so, the fitting of an artificial leg would be reduced to a mechanical operation which could be conducted by inexperienced and inexpensive persons. If the work could be done in this way, the cost of an artificial leg might be considerably lessened.

Machine Fitting a Failure.—The irregular form turning lathe, with which all mechanics are familiar, carves a stick of wood to the exact shape of the model. Axe handles, gun stocks, shoe lasts, and many other articles are made in this way. A machine of this kind has been modified so as to excavate a block of wood so it will have the exact shape of a plaster mold of a stump. A socket for an artificial leg made in this way must be greatly modified by hand before it can be worn with comfort.

When we are reminded that the stump is bone covered with muscles, fat, blood vessels, nerves, tendons, and skin; that these coverings are not of uniform thickness: that they are soft, yielding, and easily displaced: that more pressure can be applied on the least sensitive parts, and that where the nerves and blood vessels are the most numerous less pressure can be endured, we will readily see that a socket, to fit properly and not injure the stump, must be fitted by persons skilled in the work, who know the location of the large blood vessels, the character and disposition of the nerves,

and who are keenly alive to the necessity of avoiding pressure on the vascular parts. The skilled fitter does not always need the presence of the person who is to wear the leg he is fitting. Circumferences and diagrams of the stump will guide him in doing more accurate work than is possible for an incompetent fitter, though he be supplied with plaster casts, or fits directly to the stump.

When Casts are Necessary.—Plaster casts are desirable in some cases. They convey contours, locate irregularities, prominences, and tender spots on abnormal stumps, or on those that reach to the knees, ankle joints or insteps, and in such cases are quite necessary, but, generally speaking, stumps that extend to any point between the articulations do not require to be reproduced in plaster.

Wood Sockets the Best.—The advantages of wood sockets are many. Wood is light and firm, retaining the shape it receives from the skillful fitter. No matter what conditions may exist—the tender spots of a stump are always protected, weight is applied where it can be endured, and when the socket is highly polished there is absolutely no friction. A stump may move, slip, and slide without becoming blistered or abraded.

Weight.—The weight of an artificial leg varies from one to seven pounds, according to its size and the severity of the labor it is to perform. We have made artificial legs that weighed less than a pound for infants, and we have been obliged to make them seven or eight pounds in weight in order to be strong enough for active, three-hundred-pound persons. The only way to obtain strength is by the employment and proper disposition of suitable material. A small leg is not as heavy as a large one, and a strong leg must be heavier than a frail one.

Rubber Foot not Heavy.—A leg with a rubber foot can be made from six to sixteen ounces lighter than the ordinary artificial leg with articulating ankle. The lessening of weight is chiefly caused by the absence of the metallic ankle connection.

The notions of those wearing artificial legs are varied, therefore they cannot be used as guides. One man says, make my leg as light as you can, even at the sacrifice of strength; I would rather have a light leg and renew it more frequently than to carry a heavy one. Another will say, do not make my leg too light; I have worn light and heavy ones, and I find that I can walk more steadily and step more naturally with a leg of moderate weight. The leg should act as a pendulum; the moment it is lifted from the ground it should swing forward of its own weight and not depend upon energy imparted by the stump. Still another will say, I do not care what the leg weighs so long as it is made strong: strength is the desideratum. If it weighs a pound or two more I will not object to it, as I can soon get used to that, but it must be strong and last a long time. I cannot afford to take chances on the leg breaking. The utmost diversity of opinion, therefore, exists on this subject.

The greatest demand, however, is for the lightest leg, consistent with strength.

For light, delicate women, weighing less than a hundred pounds, a full-length leg weighing three pounds without attachments is as light as it is prudent to produce. So light a leg with ample sustaining strength is almost a marvel. We know of nothing calculated to withstand equivalent strains that weighs so little. A leg weighing six pounds for a large, heavy person, who is likely to subject it to severe use, is not excessive, and should not be objected to.

Let us think, for a moment, of the weight of other instruments that are made to stand similar strains. The weight of the bicycle has been reduced from sixty to nineteen pounds, and it is generally conceded that a nineteen-pound bicycle is as light as prudence will allow. Persons marvel at a bicycle weighing so little, yet the nineteen-pound bicycle has no more work to perform and is not subjected to any more strains than an artificial leg weighing from three to six pounds. The bicycle, like the leg, has only to support the weight of the rider and resist such strains as may occasionally be brought upon it.

In constructing a leg it is essential to make it strong enough to sustain the weight of the wearer and not break under such sudden strains as it is likely to receive at times. If one slips and recovers himself with his artificial leg, some part receives a strain that is much greater than the weight of the wearer. In ascending or descending stairs the strains on the leg are greater than in walking. A leg should be made strong enough to meet these demands, and, in addition, must have a margin of strength that will enable the wearer to carry such articles and lift such weights as his vocation requires. No matter how crippled one may be, or what his station in life is, nor how delicate, there will be times when he will thoughtlessly lift, carry, push, or pull some weighty object. Should the leg break under any of these conditions, the maker would unquestionably be severely censured.

It is not wise to build an artificial leg so close to the danger line, especially for delicate persons, that when those persons become healthier, stronger, and heavier the leg will break. Conditions do not remain the same. "The weak of to-day are the strong of to-morrow." The light person frequently becomes heavy, and the careful limb maker, if he guards his reputation, will keep well on the side of safety.

The average weight of a substantial artificial leg, suitable for a thigh amputation, worn by a man weighing one hundred and fifty pounds, engaged in an ordinary occupation, may be placed at five pounds, less for a below-knee or foot amputation.

It is possible to localize the weight of a leg weighing six pounds so that it will feel lighter than one weighing half as much, improperly adjusted. Inadequate means of attaching the leg to the body will make it feel heavy. A heavy lower part, with a light thigh piece, produces an apparently heavy leg, because

the weight is distant from the stump and the frail thigh piece does not hold it in place securely. On the other hand, a strong, substantial thigh piece, which properly holds the leg in place, will lessen the apparent weight considerably.

Odor.—The contention that rubber emits a disagreeable odor is untrue. Sponge rubber has no more odor than wood; moreover, the rubber foot is incased with an air-tight material. Even if the rubber had a disagreeable odor—which it has not—it would not be possible for it to escape. On the other hand, the ankle joints of articulating feet have to be oiled very frequently, and the oil in time becomes rancid. No refined person can possibly tolerate such an odor.

Temperature.—The rubber foot will not alter its consistency on account of changes in temperature. Properly vulcanized rubber, such as is used in the manufacture of our rubber feet, will not lose its elasticity in any temperature the human body is capable of enduring. It requires 280 degrees of heat (Fahrenheit) to produce a change in rubber, and as there is no habitable place on the earth with a temperature half of that, the rubber foot is never in danger from heat; no human being could live in a temperature intense enough to harden pure rubber.

The Mass of Limb Wearers are of Small Means.—The greater number of wearers of artificial limbs are in limited circumstances. It is exceptional to find a wealthy person in need of one. The wage-earner, the laborer, the man who works in the mill, the engineer, fireman, brakeman, or the miner, the private in the army, those whose occupations place them in jeopardy and who are exposed to the dangers that destroy life or mutilate the body, these make the greatest number of limb wearers. This being so, it is the more important that artificial limbs should be durable and as inexpensive to wear as possible. The first cost, the purchase of the limb, should be the only important item to be provided for. An artificial leg constructed with delicate machinery, or parts subject to friction, may be attractive to look at, but is ill-suited to the wants of the man who has to support himself and his family by daily toil. The loss of time in having repairs made, the cost of repairs, and the danger of breaking down at critical times, are serious matters, and the careful man will take them into consideration before making his selection.

We do not know an artificial leg with an ankle joint that is now made, that has ever been made, or, perhaps, ever will be made, that will not cost from five to twenty-five dollars a year to keep in repair. The delicacy with which an ankle joint must be constructed in order to be light and small enough for its narrow limits, and the immense strain that it must resist at times, are conditions incompatible with durable mechanism.

The fact that persons walk, run, and perform all kinds of labor on artificial legs with rubber feet without ankle motion is evidence that the ankle mechanism is unnecessary. Men, women, and children with rubber feet run, walk, skate, and dance. Work,

regarded not many years ago as impossible, is now being daily performed with facility. The farmer follows his plow on a rubber foot, the blacksmith works at his forge, the sailor climbs his rigging, the builder erects houses, and persons of every vocation attend to their affairs with as little concern and hindrance, operating on one or a pair of our rubber feet, accomplishing as much as their associates who are in possession of all their natural limbs.

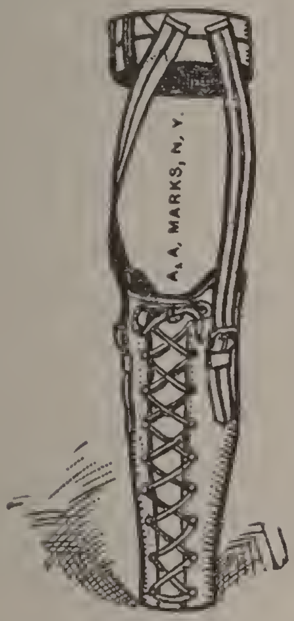
How Long Will a Leg Last?—The question is frequently asked, "How long will an artificial leg last?" There is but one reply: it depends upon the care the leg receives. We have patrons who are still wearing artificial legs that were made for them twenty-five years ago, and the legs still appear to be in fair condition. These are exceptional cases and should not be referred to, any more than should the experiences of those who, through abuse and carelessness, destroy their artificial limbs in an unexpectedly short time. An average made of the frequency with which our patrons renew their substitutes, fixes the period at about eight years. This does not imply that a leg will not last longer. Necessity by no means occasions all renewals; wearers want new legs much the same as they want new coats, before the old ones are completely gone. Wearers become as proud of their artificial limbs as they do of articles of apparel; those financially able frequently supply themselves with several, so as to have a reserve for emergencies. Accidents are as likely to occur to the substitute as to the real ones. Men have been run over by vehicles and have had their artificial legs crushed instead of their natural ones. When accidents of this kind occur, the limbs must be sent to the manufacturer for repairs. The wearer who is fortunate enough to have a duplicate which he can put on is at a great advantage. Taking all these facts into consideration, and fixing the average life of an artificial leg at eight years is certainly estimating on a fair basis.

Shoes and Stockings.—All artificial feet should be dressed with stockings and shoes, as are natural ones. The wear and tear on shoes and stockings, when the feet articulate at the ankles, are enormous and have been a source of complaint. This annoyance is removed by the use of rubber feet, for shoes on rubber feet look and wear like those worn on the natural, as the wrinkling at the toes and other parts is nearly identical in both. We have heard patrons say that in five years their rubber feet have saved them in the cost of stockings and shoes enough to buy a new leg.

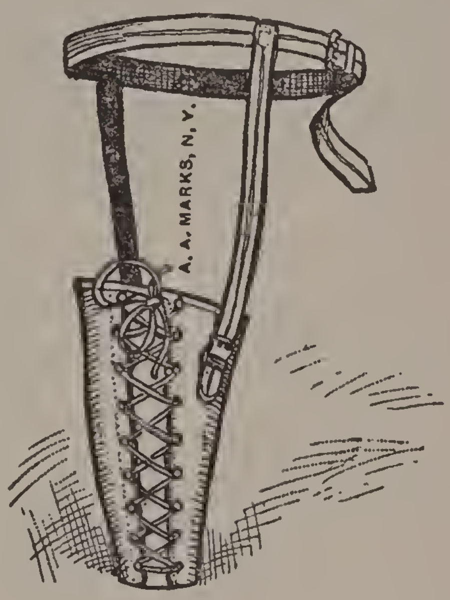
How Soon after Amputation Should an Artificial Leg be Applied?—As soon as the stump is thoroughly healed and the patient has regained sufficient strength to go about on crutches, it is time for him to consider the matter of procuring an artificial leg. Before procuring one some attention should be given to the preparation of the stump.

Treatment of Stumps.—Tight bandages should be worn from

the moment the stump is healed until the artificial leg is applied. Bandages are inexpensive and can be frequently renewed. The stump corset suggested by some is made as follows. A block of wood is carved to the shape and dimensions of the stump; a piece of substantial leather is moulded upon this form, the edges running down the front are permitted to remain apart about two inches, eyelets are put on each edge to admit of lacing, straps to hold it in place are attached as shown in the cuts. A shoemaker or saddler within the reach of the wearer can usually be found who will make the corset at little expense. No matter how soft and pliable the corset is made, it has not the adjustability of ordinary bandages, therefore its use is not encouraged.



Cut L 1.



Cut L 2.

Cut L 1 represents one with suitable straps for leg amputation and Cut L 2 represents one for a thigh stump.

The knee and hip joints should be moved very frequently, and the stump rubbed vigorously in order to maintain mobility.

No matter what means are employed to reduce a stump before an artificial leg is applied, it is doubtful if all the changes can be brought about. As a rule stumps become smaller from wearing artificial legs. The pressure received from the socket has a tendency to force absorption and solidify the tissues. The extent of this emaciation cannot be conjectured. Some stumps do not change even when artificial legs are worn for years. On the other hand, we know many cases where the stumps have grown larger. The matter is governed by the disposition of the wearer, his occupation and his activities.

If a stump reduces after an artificial leg is worn, some compensative adjustment must be employed, lining the socket with thick material as leather, felt, or cloth, or by wearing a number of socks on the stump, one drawn over the other is the most convenient way, but in case of great shrinkage, so much so that such fillings are objectionable, it will be necessary to remove the socket from the leg and substitute a new and smaller one. We do this work

for our customers at small expense, but new measurements and diagrams are required and the entire leg must be sent to us.

If the stump is one that will yield to pressure it will not only become smaller under the influence of the bandage or corset, but must grow still less by the use of the artificial leg. Under such circumstances, it is an important economical question to determine whether it may not be wiser to immediately apply a leg and change the socket, should it become necessary, than waste time in bandages or shrinking corsets.

The Gain in Applying a Leg Immediately.—The immediate use of an artificial leg enables the wearer to dispense with crutches at the earliest possible moment, to gain the freedom of his arms, attend to his vocation, and take healthy and vigorous exercise. The cost of a new socket to fit a reduced stump is insignificant when the advantages of wearing an artificial leg during the interval the stump is changing are taken into account.

Walking on crutches is dangerous, a slip or fall may seriously injure a stump. An artificial leg is the best protective device for the stump.

The single exception to the wisdom of early applications is in amputations which result from malignant diseases.

Dangers in Delay.—If a stump is permitted to go for six months without performing its share of work, it will become weak, nervous, and disordered, and circulation will become sluggish. It is much more difficult to use an artificial leg on a stump that has been permitted to get into this condition than if applied immediately after it has healed.

We have applied artificial legs within a month after amputation with good results, although this time is exceptionally brief. It is impossible to indicate the exact length of time that should elapse between the amputation and the application; it is safe, however, to say that a limb can be judiciously applied as soon as the wound is healed, even if there be tenderness on the amputated surface. It is well to remember, in this connection, that with rare exceptions the end of the stump bears no pressure whatever.

It is a common error to assume that a stump will become hard and tough in time. Nothing can harden or toughen it except use, and there is no better way to toughen a stump than to use a leg. The hands of a laborer are strong and hard because he uses them in performing his work. Those of a person not accustomed to manual labor are soft, tender, and delicate, and become easily blistered because they have not been disciplined. Exactly the same principle is applicable to stumps.

Surgeons are at variance in their views on this topic. Some advise an early application, others insist on their patients waiting an unreasonable length of time. The surgeon who has studied the subject in all its bearings invariably agrees with the advice given above.

Cork Legs.—The term "cork leg" has long and frequently been

used to designate an artificial leg. The prevailing impression is that there is or has been an artificial leg made principally of cork. This is an error and should be corrected. Cork is known to every mechanic as a very friable substance, on account of which it has not strength enough to form any part of the supporting structure of an artificial leg.

The origin of the term "cork leg" is not known. It has, however, been said by credible authority, that the term originated from the fact that years ago very good artificial legs were made in Cork, Ireland, which were called Cork legs, the same as legs made in London are called London legs, those made in New York are called New York legs, etc.

There have been many doggerels written in which the word cork is used to designate an artificial leg.

Thomas Hood, in his Golden Legend, "Miss Kilmansegg and Her Precious Leg," speaks of cork and wooden legs, neither of which was good enough for the fastidious Countess:

> "She couldn't, she shouldn't, she wouldn't have wood,
> Nor a leg of cork if she never stood!
> And she swore an oath, or something as good,
> The proxy leg should be golden!"

It is evident that at the time the above was written, many years ago, the term "cork leg" was misunderstood the same as it is now

CHAPTER XIII

ARTIFICIAL LEGS FOR THE AGED

To be deprived of a natural leg after having passed the allotted span of life is indeed a calamity, and the thought of wearing an artificial one is entertained with forebodings. Will not the infirmities of age come fast and heavy? Has not the shock sapped the vital reserve so that early decline will make the purchase an unprofitable one? Is the prospect of living a few years promising enough to justify the attempt? These are questions of gravity that come with force especially to those in moderate circumstances.

As is shown in another part of this book, the loss of a leg, no matter how old or enfeebled the patient may be, instead of hastening the fatal day, has a tendency to give a new lease of life. The removal of a diseased leg serves as a tonic to the entire system. If the finger of death has been laid upon the foot, as in senile gangrene, remove the foot and the decay will cease.

Like cutting the dying limbs from an old tree, the vital forces will be more generously distributed among the remaining parts and the tree will take on new life.

It is no greater task to learn to walk on an artificial leg than to learn to use crutches, and as a matter of fact an artificial leg is much safer. To put an aged person in a rolling chair and deprive him of the health-giving walks is to invite disaster. The aged as well as young will rust out sooner than they will wear out,

Age must not be taken into consideration; as soon as the stump is healed an artificial leg should be obtained; in a very brief time the wearer will be able to get about without depending upon others. Walks in the open air and healthful exercise will be indulged in, and gratifying results will follow.

A few cases bearing on this matter may be cited:

The Rev. Edward Beecher, of Brooklyn, N. Y., brother of the famous Henry Ward Beecher, lost a leg by accident in his eighty-fourth year. For several years prior to that time there were evidences of senility, and when he met with his accident it was not supposed he had vitality enough to survive it. Amputation, however, was proceeded with. Mr. Beecher recovered from the shock, and in a very short time was convalescent. He was soon able to take short walks on crutches, but the fear of falling made the task difficult and exhausting.

The writer well remembers when he was summoned to this distinguished clergyman's house. He was seated in a chair, looking very tired. He had just returned from a walk on crutches. "I am a very old man," he said, "and I do not think I have long

to live. The idea of buying an artificial leg appears to me a piece of folly; but my friend, Mr. Sage, is insistent that I should get one and try it. Whether I succeed or not, it will make no difference to you, but considerable with me. If I ever learn to walk on the leg I know I shall feel better, and I am going to try."

The leg was made and applied, and in a very brief time he acquired the art of walking on an artificial leg. He moved cautiously at first, but soon got so that he could put entire confidence in the limb. He took long walks daily, and attended to his church and parish work with renewed vigor. The leg was much easier for him to walk on than crutches, and gave him a feeling of security. He wore it for eight years, when he died at the age of ninety-two. Is it reasonable to assume that, if Mr. Beecher had not applied an artificial leg, but had resigned himself to the cot or rolling chair, he would have lived to that ripe age? Did not the walking that he was able to do, and the open air exercise, contribute to his health, and add to his life? The denial of an artificial leg would certainly have been a severe punishment to this good man for having lost his leg in old age.

Charles Van Brunt, of Long Branch, N. J., had his foot amputated on account of senile gangrene when he was seventy years old. An artificial leg was applied as soon after the amputation as prudence admitted, and he lived for fifteen years and wore the leg constantly. He died at the age of eighty-six. During much of the time he performed the duties of school janitor.

George Hinman, New Haven, Conn., had his leg amputated when he was eighty years old. He obtained an artificial one and wore it continuously for four years, during which he was active on his feet and walked long distances.

Mrs. Susanna Brown had her leg amputated above the knee when she was seventy-three years of age, a result of an accident. An artificial leg was applied four months after the amputation. She wore it three years and was active in domestic work. Dr. A. L. Britten, of Athens, Ill., writes about this case as follows:

"Mrs. Susanna Brown, of Cantrall, Ill., for whom you manufactured an artificial leg after she had passed her seventy-third birthday, found it eminently satisfactory. She was helpless in no sense. She could, and did, ascend and descend stairs without assistance, and without fear of falling."

David Penfield lost his leg on account of gangrene when he was seventy-two years of age. Dr. White, of Franklin, N. Y., in one of the letters says of the case: "The facts in regard to David Penfield are briefly told as follows: He was in the seventies when I first saw him, and had had two attacks of cerebral apoplexy, which left one arm and one leg paralyzed to such an extent as to make walking and use of arm impossible. Gangrene presented itself and I amputated the foot of the affected leg. He recovered, and I obtained an artificial leg from you for him. He very soon learned to use it, and was able to walk about fully as well as before

his trouble. He lived a considerable time after he obtained the leg, and found it a source of great comfort. His family and I regard the wearing of the limb as having added to his comfort and health."

Nelson Stevenson, Salem, Ind., had his leg amputated above the knee when sixty-seven years of age. An artificial leg was applied a few months later, which he wore for over three years.

Frederick Triebold, St. Paul, Minn., had his leg amputated above the knee when seventy-four years of age (in 1894). An artificial leg was applied eight months after the amputation which he is still wearing (1905). Dr. A. H. Steen, in writing of the case, says, "Frederick Triebold considers the artificial leg made for him indispensable, his health is good, and he wears the leg at all times."

Russell Perkins lost his leg in 1894, when he was sixty-nine years of age. An artificial leg was applied within eight months. Dr. William R. Lough, of Edmeston, N. Y., says, "Mr. Perkins gets along well with his artificial leg. He does his chores around the farm, and frequently comes to town. He does not use a cane and gets along very well."

James R. Bugbee lost a leg when he was seventy-six years of age on account of a fall. He had an artificial leg applied, which he is still wearing with great comfort. In one of his letters he says, "I am now seventy-nine years old. I am able to do my work around the house and garden, which I positively could not do with crutches."

William P. Hiller, of Nantucket, Mass., lost a leg in the Civil War. He is still living, and has worn an artificial leg continuously since. He is now eighty-two years of age.

Mr. Bradford Beal had his leg amputated in 1894 at the age of eighty-three. The leg was applied the following February, and he wore it with comfort and relief for over five years. We quote from a letter: "I am wearing the artificial leg constantly. I go about the house without cane or crutch. I have walked a mile from home and back a number of times without fatigue."

Equally encouraging reports can be given of hundreds of similar cases.

CHAPTER XIV

ARTIFICIAL LEGS FOR INFANTS AND CHILDREN

The Problem Considered.—It is a serious problem that confronts the parents of a child who has had one or both legs amputated. The parent, in happy possession of all his limbs, realizes more keenly than the child the misfortune that has happened. An artificial leg is, no doubt, the immediate and only remedy that can be suggested, but even this presents thoughts of expense for remodeling, and the question is often asked if the benefits will justify the costs incurred, and whether it may not be better to wait until the child has obtained his growth, before equipping him with the needed limbs.

A child, however young, is as greatly disabled by the loss of a leg as an adult. If one leg is lost he becomes dependent on crutches; if both legs are lost, he has to be carried in the arms or pushed about in a rolling chair, or is obliged to hitch himself about on his haunches as best he may. Such methods are at once unnatural and objectionable; they have a hurtful effect on the physique of a growing child, as well as harming the limbs, stumps, and joints. Walking on a pair of crutches for any length of time pushes the shoulders forward, settles the neck in the chest, and the spine fails to develop the sustaining strength demanded in later life.

Walking on one crutch, as most children do, cants the body sidewise, elevates one shoulder above the other, tilts the pelvis, and produces an over-development of one side of the body at the expense of the other. If the use of crutches is continued throughout the growing period, the disproportions resulting from unequal development will bring troubles that will last through life and imperil health. The stump, being pendent from the body and performing no functions, will become poorly adapted to the use of an artificial leg. The muscles will become atrophied, the joints enervated, and the range of motion lessened. It will be troublesome to wear an artificial leg under these conditions, and the task of disciplining the stump will be more difficult. It is doubtful if the harm thus done can ever be righted.

We can cite many cases where the neglect to apply an artifical leg to a growing child has been the cause of physical weaknesses that have been impossible to correct. Contracted hips and knees, weakened spines, deflected and rotated stumps, are a few of the many ills that have been traced to this neglect.

Failure to apply artificial legs in double amputations is

attended with more serious consequences. The stumps are held in flexed positions and subjected to such unnatural influences that the wearing of a pair of artificial legs, when undertaken later on, is greatly hampered. The art of balancing is forgotten and has to be learned again. The hip joints, having been in flexed positions during the greater part of the development period, have become more or less set, and extension is difficult and painful when the erect position is attempted.

Support from the Pelvis More Natural.—An artificial leg applied to a child, no matter how young, supplies a support to the amputated side that is the nearest approach to nature. It gives freedom to the arms, the joints and muscles are kept in activity. Being propped from the pelvis instead of from the shoulders, the spine, chest, and shoulders are not distorted, but are as free to perform their functions as if the child had never lost a limb. All the parts of the body maintain their proper relations and develop symmetrically.

The child invariably becomes expert in the use of one or a pair of artificial limbs, if applied soon after amputation; he mingles with other children, and engages in the same sports and exercises, the variety, which makes him strong mentally and physically, keeps him healthy, and prepares the foundation for the vigorous manhood and active life before him.

Alterations for Growth.—A child will outgrow his artificial leg, but this does not entail a serious loss; the leg can be altered in length and size to accommodate his growth and development. The expense attending such changes is not large, no greater than that of changing or renewing crutches, or repairing rolling chairs.

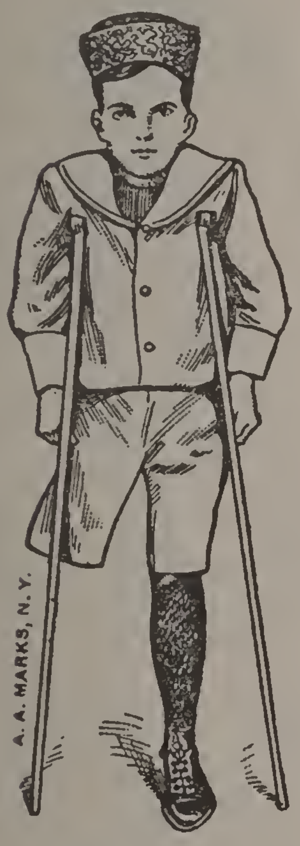
The only growth of the child that affects the length of the artificial leg is that which takes place in the sound leg from the knee to the floor. A child may, in the course of two years, grow four inches in his entire height, but the growth in the sound leg, from the knee to the floor, will be less than an inch. It is, therefore, evident that a child growing four inches in height will not require his artificial leg to be lengthened over an inch.

Frequency of Alterations.—The frequency with which an artificial leg worn by a child is lengthened, is about once in two years, oftener if the growth is more than usually rapid, and the expense attending each lengthening is not over $5.00. In families where economy has to be exercised to an extreme degree, the lengthening of the leg can be deferred, if necessary, by increasing the thickness of the sole and the heel on the shoe worn on the artificial foot as soon as growth requires. The size of the leg can be increased, and the foot can be enlarged, and in this way the leg can be made to last from five to ten years. It will thus be seen that in extreme cases a child can be supplied with an artificial leg, and the leg can be kept in proper length, at an expense of about $2.50 a year. We can hardly conceive of a parent who is so poor that he cannot meet this expense, or who

is so heartless that he would see his offspring hobbling about on crutches during his youth merely to save so small an expenditure.

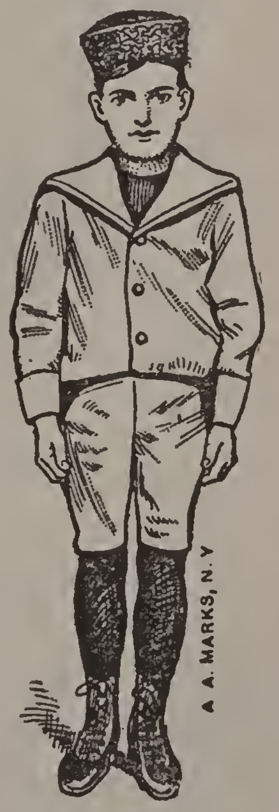
The Parents' Moral Obligation.—Duty is the most important matter to be considered. All parents are bound by the laws of nature, as well as by those of the State, to perform those services that will protect the health and comfort of their offspring, to care for them in sickness, to lessen their afflictions, and alleviate their sufferings. It seems a flagrant violation of these laws for a parent to require his child to go on crutches, subjecting him or her to the dangers of impaired health and arrested development, when an artificial leg can be easily obtained and cheaply maintained, a leg that will perform such important work in ameliorating the child's condition. An artificial leg should be regarded as indispensable, more important than fine clothing, and next to the food that is required to sustain life. No conscientious parent, in viewing all the facts connected with this important subject, can hesitate in deciding on what course to pursue. If financial resources are limited, there should be no disgrace felt in calling upon friends for assistance; the urgency is too great to be neglected through scruples. The child must be rescued from a life of torture and embarrassment, and the parents must act to save themselves the censure and rebuke that neglect of this kind will bring in later years.

Deformities from the Use of Crutches.—Look at the child who is required to go about on a pair of crutches (Cut M 1).



Cut M 1.

Cut M 2.



Cut M 3.

See how the shoulders are pushed upward, how the head leans forward, the chest sunken, and how generally disfigured he appears. Look at the child who hobbles about on one crutch (Cut M 2), see how one shoulder is raised higher than the other; how

the body is thrown to one side, the sound leg deflected, the neck crooked. Now, look at the child who has been cared for humanely (Cut M 3), who has been given an artificial leg and propped in a natural way on the amputated side.

He is the picture of symmetry, his health is robust. No one would suspect that anything unusual had occurred to him, his artificial leg performs the functions of the lost one. He has forgotten his loss, and never admits his disability. He does everything his companions do; he is in the ball game with them, he rides the bicycle, skates, dances, and is not denied a single privilege belonging to those in possession of their natural extremities. "To clinch the nail of theory with a few blows from the hammer of experience" we cite a few cases that have come under our observation.

Practical Illustrations.—Cuts M 4 and M 5 portray Mabel T., who, when less than nine months old, had her left leg ampu-

Cut M 4.

Cut M 5.

tated very close to the knee. After recovering from the operation, it was discovered that the tendons of the knee were contracting and the stump being drawn into a flexed position. The mother became alarmed and consulted her physician. It was feared that if the child was permitted to continue as she was, she would, in a short time, lose the use of the knee joint. She had not begun to creep. It was evident that if an artificial leg were applied, the stump would be forced into such activity that the knee mobility would be preserved, and one was obtained. The

socket was made to fit the stump snugly, the joints were placed on the sides to harmonize with the natural knee joint; a thigh piece incased the thigh. The leg would swing when the child was carried, and forced the stump to move at the knee.

In a few months the child began to creep. The mother was surprised one morning to find her standing by the chair, putting some of her weight on the leg. It was not long before she began to walk, then to run and play. The leg was lengthened quite frequently, and enlarged several times. During her childhood she ran and romped about as other children, went to school, and was as happy as any of her companions; she is now a young lady of twenty-two. Although her parents were in moderate circumstances, they always felt that their daughter's health and perfect development were important, and they denied themselves many things, but considered themselves amply compensated for the care they had given to the needs of their daughter.

Carrie K., when seven years of age, was run over by a carriage and lost her left leg. An artificial one was applied as soon as the stump had healed. The distinguished Dr. James Knight, the founder of the Children's Hospital in New York City, took the case in hand, and realizing the importance of putting the child on a leg instead of keeping her on crutches, interceded in her behalf. A leg was applied and she grew up with it; she developed gracefully and now is a woman of forty-three years. Cut M 6 represents her as she appeared when brought to us in 1869. Cut M 7 represents her with artificial leg applied, and Cut M. 8 gives her as she appears to-day, a thankful wife and a happy mother.

Thomas Kehr, when eight years of age, was run over by the cars, both of his legs were crushed, the right was amputated four inches below the body, and the left two inches below the knee. As soon as the child recovered from the operation Dr. Samuel J. Brady, of Brooklyn, advised that he be provided with a pair of artificial legs with rubber feet. They were obtained and applied, and the manner in which the young man got along is clearly stated in Dr. Brady's letter of 1876, from which we make the following extract: "I have thoroughly examined the case of the boy Thomas Kehr, who has been wearing a pair of artificial legs for six months. About a year and a half ago he was run over and both of his lower limbs were so crushed that I amputated them, the one well above the knee, the other an inch and a half below. At the time of the operation many expressed the wish that death would occur, as the lad being very poor, it was thought that his future would not only be a burden to himself, but that his support, should he reach man's estate, would depend upon the charity of the public, as it was considered an impossibility for him to serviceably use artificial limbs.

"I am thankful that I can say that Marks' artificial legs have made his future worth the living.

"I saw him two weeks after he had put the legs on for the

first time, and it astonished me greatly to see the remarkable use he had so soon acquired; since then I have seen him many times, and quite recently I saw him walking without the use of canes. He has, much to my astonishment, been fully and absolutely restored.

"I attribute the wonderful success in this boy's case mainly to the superior results achieved by your inventions, and to the

Cut M 6. **Cut M 7.** Cut M 8.

fact that the legs were put on so soon after the amputations that the stumps had not had a chance to forget their functions."

Mr. Kehr is now a man of forty years. He is an active, capable, energetic workman, in perfect health, earning his livelihood and maintaining a family. If this man had been neglected in his childhood, he would be to-day a helpless object of pity, instead of a self-supporting member of the community,

Annie L. Beckwith lost her leg below the knee in 1887, when she was seven years of age. An artificial leg was immediately applied. It has been lengthened several times since. She is now a woman of good proportions, strong and healthy. Cuts M 9 and M 10 represents her as she appears without and with her artificial leg.

Manuel Parraga, of San Salvador, Central America, had his leg amputated above the knee in 1876, when eleven years of age. An artificial leg was applied immediately. His weight at the time was seventy-five pounds. The lad has developed into a full-

grown man, weighing two hundred pounds. He is strong, healthy, and has a model stump, and walks about in the most natural way. In a letter recently addressed to us he says: "For a long time I have been desirous of writing to you and expressing my continued satisfaction in the work that you have done for me. Since I have returned to Central America I find it necessary to make long journeys on horseback. The artificial leg assists me very much. I pride myself on my easy and graceful movements, and the facility with which I mount and dismount. The India-

Cut M 9.

Cut M 10.

rubber foot on the artificial leg is a most excellent invention; without it I question my ability to walk with safety in this country, where the streets are so rough and stony."

John Jerome Booth, son of Dr. J. P. Booth, had his leg amputated when seven years of age; railroad accident. An artificial leg was applied when he was eight years old. He then weighed fifty-seven pounds. The young man has grown and developed symmetrically and is now twenty-four years of age. He refers to the early application of his artificial leg as an exhibition of good judgment on the part of his father, for which he feels greatly indebted. He says that if he had been neglected when he was young, he would not be in possession of his present strength and proportion.

George G. Griswold had the left leg amputated below the knee when twelve years of age. An artificial leg was applied

within a year after amputation. We quote from a letter written by his father. "The leg was applied to my son when he was less than thirteen years old, fitted from measurements without requiring his presence, has been in constant use. I hardly know of anything that he cannot do that other boys of his age can with sound limbs. He walks, skates, plays ball (Cut M 11), and

Cut M 11.

climbs trees. When he was sixteen years of age we moved to another town, and for about a year scarcely a single schoolmate or neighbor ever suspected that he wore an artificial leg. I do not think it is possible to find an artificial leg equal to that which you construct for young and growing children. I have never regretted having applied an artificial leg to my son on account of his tender age."

William T. Wilson, when fifteen years of age, was run over by a railroad car and had his leg mangled so greatly that amputation was necessary. A few months after an artificial leg was applied. He weighed one hundred and ten pounds, and was at the period of life when growth and development promised to be rapid. The artificial leg was lengthened twice in four years.

James Good, at the age of thirteen, was run over by the cars and the left leg amputated below the knee. Seven months after amputation an artificial leg was applied; age fourteen, weight eighty pounds. The boy has grown to a man of large proportions, and at this writing is a locomotive engineer.

George W. Sheridan, son of General George A. Sheridan, was thrown from a carriage by a runaway horse, when he was ten years old. One leg was crushed and had to be amputated below the knee. Nine months later his mother, becoming solicitous about the child's development, insisted on an artificial leg being obtained, this in opposition to the advice of her husband and family medical adviser. The mother gained her point, and a leg was applied, and the child used it immediately, and the effect upon his health was surprising. We quote from the General's letter: "My son is now fifteen years of age. He has worn a leg of your make for the last five years, always with comfort and satisfaction. When visiting him at his school a while since, I found he was out for a day's fishing. When he returned and stated where he had been, the teacher remarked that he had walked at least ten miles. George skates on steel or roller skates, rides a bicycle, and in short enjoys to the full the usual sports of boys of his own age. I now realize that it would have been a mistake, almost a crime, to have made the boy wait until he had stopped growing before supplying him with your artificial leg."

Hattie L. Moore had her leg amputated at the age of thirteen. Six months after the operation an artificial foot was applied. She wore it five years without lengthening. The growth of the natural foot, from the ankle down, was not great enough to require any alteration in the artificial foot. We quote from her letter: "My foot was amputated when but a child of thirteen, and as soon as the stump had healed, I had one of your admirable rubber feet supplied, made and fitted from measurements. It fitted me as if I had gone to New York and had had the foot fitted by your own hand. I have used the foot four years now, to the untold satisfaction of myself, and the utmost gratification of my friends, who often tell me that they would never notice anything peculiar about my walk. I have lived with people nine months without their discovering that I was lame.

"I am at present doing a daughter's part of housework, standing on my feet the greater part of the time."

William E. Shaw, leg amputated for injury to the knee. An artificial one was applied when nine years of age. To quote from his father's letter: "My boy has had great success with the artificial leg that you made for him. He can walk and get about excellently. He would not be without it for anything. It is unquestionably the best thing for a child, when he has lost one of his legs, to get an artificial one without delay."

John Kershaw, leg amputated above the knee, railroad accident. Artificial leg applied when ten years of age, immediately after the healing of his stump.

Dr. A. C. Dedrick writes: "I passed John Kershaw in the street three months ago. From the success in his case I certainly advise the application of an artificial leg to a young and growing lad as soon as the stump has healed. John Kershaw has been able, thanks to the artificial leg, to enjoy his early life equally

with others not so unfortunate. He plays football, baseball, and all other sports. I think he would have lost all power of stump if the leg had not been employed. The stump is only about six inches long, and would in all probability have become flexed if he had grown older without a leg to keep the hip joint in condition."

Flossie Lee, leg amputated below the knee. Artificial leg applied when four years of age. Dr. G. A. Harris, of Chepachet, R. I., writes, "Flossie Lee has worn an artificial leg, which you fitted her five years ago, continuously since that time, except when sent to you for lengthening. It is needless to say that her health, in both mind and body, is different from what it would have been had she been confined to the house all these years. She has been to school, and runs about like other children, which means everything to a growing child. No change has been made in the leg all these years, except the increase in length."

Thomas McAleer, leg amputated above the knee on account of accident. Artificial leg applied when seven years of age. Dr. D. K. Dickinson writes: "McAleer, whom you so nicely fitted with an artificial limb for amputation above the knee joint, has received great satisfaction. I recommend the application of a limb by all means in similar cases."

Ettie Stangl, leg amputated below the knee in 1889. David Jones, of Richardson County, Neb., writes in regard to the case: "Ettie Stangl, to whom you applied an artificial leg when she was very young, has worn it continually. She does not appear like a cripple, she moves about so naturally. I can say that the artificial leg was a source of comfort to her, and I think providing her with the limb when she was so young was the best thing that could be done for her health and comfort."

Mary Wiley, both feet amputated in 1891; cause, railroad accident. Artificial feet were applied several months later. She was then eight years of age. This little girl is a forcible example of the wisdom of applying artificial limbs to children, especially when both are amputated.

Clarence Wintersgill, both legs amputated; right, six inches below, and left, three inches above the knee; cause, railroad accident. Artificial legs applied within a few months. Age, seven. Dr. R. F. Wintersgill writes as follows: "In regard to my son's case, the application of a pair of artificial limbs has been a wonderful success. He was but seven years of age when you made his limbs, but learned rapidly how to use them. He now skates, rides a horse, goes to school, and walks several miles without resting. I was advised not to get Clarence any limbs until he had ceased growing and had almost made up my mind to wait, but to look at my little child sitting out in the yard helplessly, and to think that he must do so until he had finished growing, made me almost frantic. In the meantime, one of my neighbors provided me with one of your books, and I studied it day and night until I came to

the conclusion to try a pair of your legs, with the results mentioned above.

"You will remember, Clarence's left leg is off above the knee and the right below the knee. He was wearing his artificial limbs one year after amputation, and if I had to do it over again he would wear them in one month."

John E. Palmer, leg amputated below the knee. Artificial leg applied within six months; age, nine years. His father, Bradford Palmer, writes: "I am glad to let you know what success my boy has had in using his artificial leg. He was only nine years old when he commenced wearing it. I can say that it has afforded him the greatest satisfaction, and he could in no way be induced to do without it. He is growing fast and has the best of health."

Anton Gaub, leg amputated in 1884. Artificial leg applied within a few months after amputation; age, four. Gaub is now (1905) twenty-five years of age, full grown and well developed. He has always used the leg and never cared for crutches. He is strong, in good health, and walks great distances without becoming fatigued. He is actively engaged in business. His parents refer with pride to their decision in putting him on an artificial leg when he was so young.

Roscoe E. Bosworth, leg amputated below the knee in 1890; age, nine years. His father, Levi Bosworth, of Worcester County, Mass., writes: "I consider that it was a very wise thing on my part to have supplied my boy with an artificial leg when he was so young. He now has full use of his knee and hip joints, which I think would have become greatly impaired if he had not used the leg. He is now in good health, well developed. Crutches, which he used for a short time, always made him sick.

"Roscoe has skated, ridden a bicycle, and done almost everything other boys do. If I had a child only two years of age and he needed an artificial leg I would put one on immediately."

Roy V. Bryant, leg amputated above the knee when seven years of age; artificial leg applied immediately. His father writes as follows: "My son has worn his artificial leg constantly, with the exception of times when it has been at your factory for lengthening. He is now twenty years of age. He has grown straight, strong, muscular, well developed. I am thoroughly convinced, from the experience in my own son's case, that an artificial leg cannot be applied when a child is too young."

Carl T. W. Banks, leg amputated above the knee; railroad accident; artificial leg applied within six months after amputation. His mother writes: "The question of applying an artificial leg to a young child was one of great thought to me. Many of my friends thought it unwise to do so, but I could not bear to see my son Carl going on crutches, so I got a leg and had it put on when he was only seven years old. He has been wearing it since, and he is now well developed, strong and healthy. During his childhood days he played with other boys, in all kinds of weather and at all kinds of games."

Emma Zern, leg amputated above the knee. Dr. J. William Trabert, of Annville, Pa., writes: "Emma Zern's leg was amputated in the lower third of the thigh in 1890, when nine years of age. She received an artificial leg from you within six months. She has been wearing the same constantly. In the following spring she grew 2½ inches. The leg had to be lengthened, but it did not cost very much to do it.

"At first I was doubtful that a child of her age should have an artificial limb, but am now convinced that a child cannot be too young, as this case has shown."

Nellie Cartwright, at the age of eleven, met with an injury to her leg that necessitated an amputation below the knee. Six months after an artificial limb was applied. Her father writes: "I purchased an artificial leg from you for my daughter in 1893. She was then eleven years old. She has used the leg constantly. I am delighted with the results and prepared to say that I recommend the use of artificial limbs to children of any age, and the sooner the child has a leg applied after losing a natural one the better it will be for that child. There are two reasons that should induce a parent to act promptly: First, an artificial leg enables a child to walk naturally, promoting good health and symmetrical growth. Second, a child becomes accustomed to the use of the limb while young and active and will ever afterwards use it with better results than it could if the use was delayed until maturity."

Clara Giere, leg amputated below the knee; age, eight. An artificial leg was applied immediately. Dr. E. Alonzo Giere, of Hayfield, Minn., writes: "The artificial leg which I obtained for Clara has given good satisfaction. The child has grown and the leg has had to be lengthened. She is still using it with comfort."

Dr. A. R. Eaton, of Elizabeth, N. J., under date of March 31, 1904, writes: "The facts of my case are as follows: In March, 1891, I had my left leg so badly crushed as to require a supracondylar thigh amputation (Gritti-Stokes type). In May of the same year I applied one of your artificial legs and wore it for a considerable length of time. Since I have attained my growth I have had another one made. The leg was a blessing to me from the start. As a matter of fact, I would have been lost without it at any time. I walk easily long distances, sometimes ride a bicycle, other times ride a horse; I play tennis, golf, etc. In fact, do with ease and facility almost all ordinary things.

"My observation leads me to believe that this excellence of locomotion is only possible with the Marks leg, for I see cases similar to my own using ankle-joint legs who are able to enjoy only ordinary usefulness.

"In regard to the application of artificial legs to young and growing children, I can say that my own case is an example. The artificial leg was applied when I was thirteen years old. I am now fully grown and am a physician engaged in active practice. My professional knowledge tells me that it is a most advis-

able procedure, for the use of a leg strengthens the stump, prevents atrophy of joint structures and soft parts, and trains a child in the use of a leg, and when he reaches adult life he will have perfect control over it, and he will become strong and healthy."

Charlie Moore, at the age of eight, had his leg crushed by a wagon. Amputation was above the knee. His mother writes: "My little son, Charlie Moore, when eight years of age, met with an accident that resulted in the amputation of his right leg. He went on crutches two years. He was pale and sickly and grew but little. The doctor said he was sure that the constant use of crutches would induce spinal disease or lung trouble. I therefore resolved to get an artificial leg for him. I did so, and as a result he now has good health, is well grown and thoroughly developed. I advise buying your make of artificial limbs for young and growing children. They are light and strong in construction and easily lengthened."

CHAPTER XV

HOME MEASUREMENTS

Our system, devised and inaugurated years ago, by which measurements and diagrams for artificial limbs can be taken at home by the family physician or the subject himself, assisted by some member of his family, and our method of fitting and constructing artificial limbs from such data, have proved so satisfactory that we encourage those desirous of saving long, tedious, and expensive journeys to have their limbs made from measurements while they remain at home.

This feature has placed our facilities and skill within reach of those who are in need of artificial limbs, no matter how distant they may reside from us; it affords an opportunity to obtain the best at the least possible expense and trouble.

So successful have been the results obtained from this method that expressions of gratitude and commendation have come from the most distant parts of the world. Men of prominence, as well as those not so frequently in public mind, have benefited by the plan.

We have customers living within a few miles of New York City who are so actively engaged that they prefer to have their limbs fitted from measurements under the guarantees we give, rather than absent themselves from their homes.

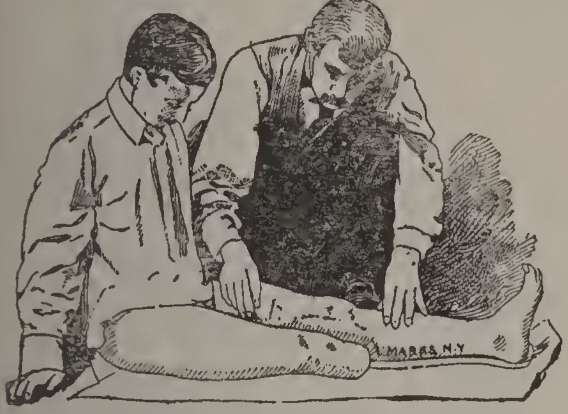
To encourage persons to have their limbs made in this way, we agree to make all changes or reconstructions without charge, whether such are required on account of errors in measurements or changes in stumps, or any other cause whatever.

If anyone desires to be present at the fitting, we will not dissuade him from his intentions, and will give him immediate attention on his arrival.

As soon as measurements and diagrams are received, we subject them to the closest scrutiny, and if errors or omissions are discovered, they are returned for corrections, and if there are any indications that successful fittings from measurements are doubtful we do not hesitate in notifying the party to that effect. As soon as we accept the data we assume all risks, we make the leg accordingly and forward it to the client with full instructions for its application. Should it fail to fit properly, it can be returned with particulars, and we will alter or reconstruct it without charge.

INSTRUCTIONS WHEN ONE LEG IS AMPUTATED

Diagrams.—First, make a diagram of both the sound and amputated legs. This is done by removing the clothing and sitting



Cut N 1.

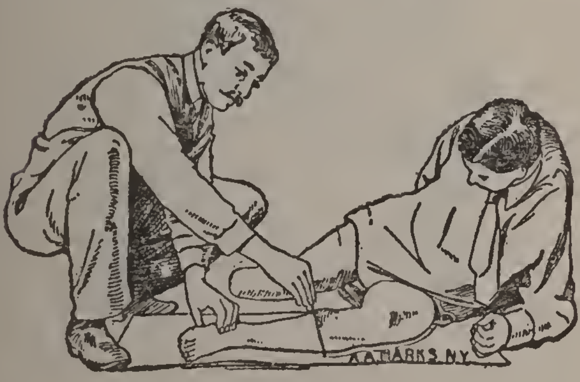
Cut N 2.

on a large sheet of paper, with both the sound leg and the stump extended and slightly spread apart, the foot pointed directly

Cut N 3.

Cut N 4.

upward. Beginning at the body, draw a pencil down the outside of the sound leg from the hip, around the heel and up the inner



Cut N 5.

Cut N 6.

side to the body. Then carry the pencil down the inner surface of the stump and around the outer side to the hip. Cuts N 1 and N 2 show the manner in which this is done if the amputation is

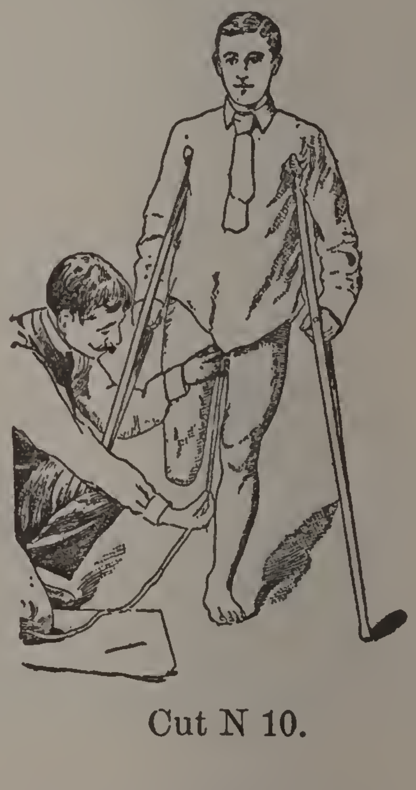
below the knee; Cuts N 3 and N 4 show the same if the amputation is in or above the knee. For side diagrams, it is necessary for the patient to lie on one side with the knee bent at right angles and then pass the pencil around the leg, as shown in Cut

Cut N 7.

Cut N 8.

N 5. If the amputation is below the knee, turn on the amputated side, resting the exterior surface of the stump and thigh on the paper, and mark around it, as shown in Cut N 6. Then, without changing the position of the body, flex the knee to about right angles, and mark around the thigh and stump, as illustrated in

Cut N 9.



Cut N 10.

Cut N 7. These diagrams will show the amputated leg in two positions, one with the stump fully extended, and the other flexed at right angles. If there is a limited motion in the knee joint, special care must be taken that the limits of extension and flexion

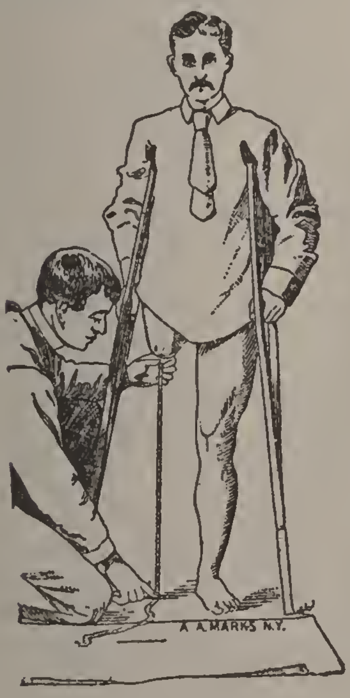
are shown in the diagrams. Then place the foot on the paper and draw a line around it, as shown in Cut N 8.

MEASUREMENTS.—After the diagrams come dimensions. Measuring should be done in the morning when the stump is not

Cut N 11.

Cut N 12.

swollen; a tape line should be used. Begin with measuring the distance from the crotch, or perineum, to the floor—the end of the tape line must be put close to the body between the legs and carried vertically down to the floor (see Cut N 9); in the same



Cut N 13.

Cut N 14.

way measure the distance from the crotch to the end of the stump (see Cuts N 10 and N 11). Measure from the end of the stump to the floor, as shown in Cut N 12 or Cut N 13.

While still standing take the circumferences of the sound thigh,

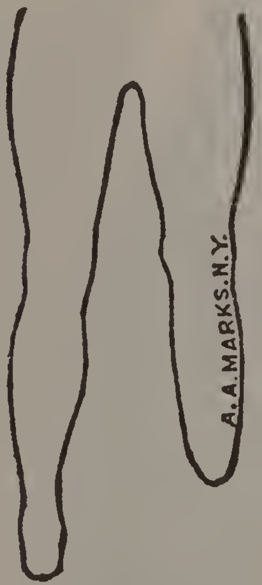
beginning close to the body, as shown in Cut N 14, repeat at points two inches apart, until the knee is reached, then take the circumference of the knee around the knee-cap, then the following

Cut N 15.

Cut N 16.

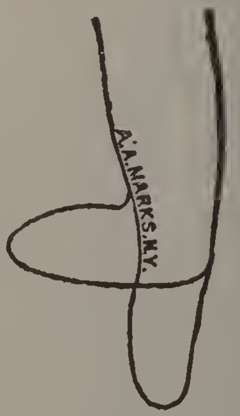
circumferences; the leg immediately below the knee-cap, the calf, smallest part of the ankle, just above the joint, the heel and instep, the instep, the foot at the base of the toes; then measure the length of the foot.

If the amputation is below the knee, take the circumference of the thigh close to the body (see Cut N 15) and repeat these cir-

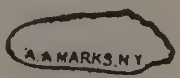


Cut N 17.

Cut N 18.



Cut N 19.

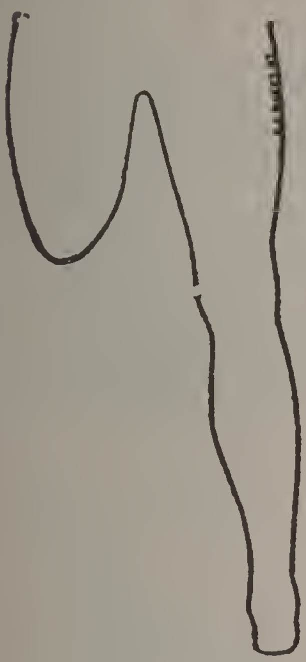


Cut N 20.

cumferences at points two inches apart until the entire thigh is measured; then take the circumference of the knee around the knee-cap; then take the circumferences of the stump, beginning immediately below the knee-cap, and repeating at points two inches apart until the entire stump is measured. If the amputation is in or above the knee, take the circumference close to the

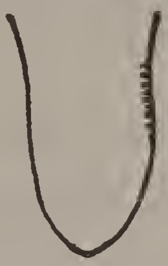
body and repeat at points two inches apart until the entire stump is measured.

After the circumferences have been taken, measure the distance

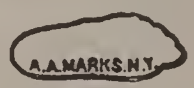


Cut N 21.

Cut N 22.

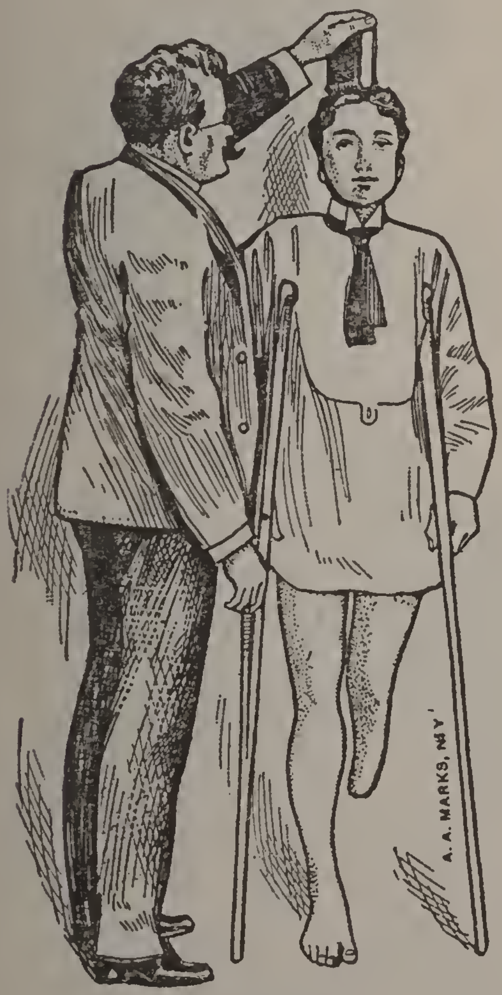


Cut N 23.



Cut N 24.

from the top of the knee of the sound leg to the floor when seated in a chair, with the leg bent at right angles (see Cut N 16).



Cut N 25.

Cut N 26.

Write all these lengths and circumferences on the diagrams in their respective places.

If correctly made, the diagrams of an amputation below the knee will resemble those figured in Cuts N 17 to N 20; for amputation in or above the knee they will resemble Cuts N 21 to N 24.

Other required measurements include the height of the person when standing erect on the sound leg. This can be taken by standing against a wall and the height marked by a book or carpenter's square (see Cut N 25); the distance from that point to the floor should then be carefully measured; then sit on the bare floor, with the back against the wall, and note the height from the top of the head to the floor, as shown in Cut N 26.

These heights are wanted to verify the length given of the leg. The height from the head to the floor when sitting subtracted from the height when standing is equal to the length of the leg.

INSTRUCTIONS WHEN BOTH LEGS ARE AMPUTATED

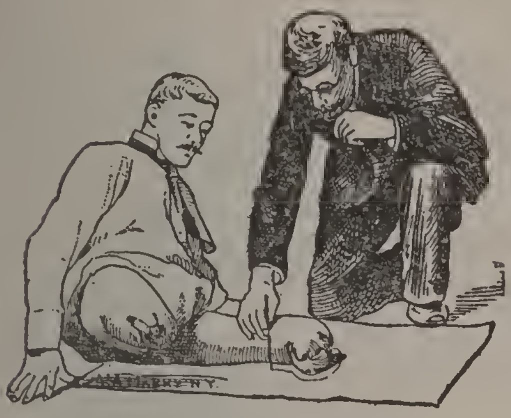
If both legs are amputated, either above or below the knees, or if one is amputated below and the other above, it is necessary to make diagrams of each stump and thigh, presenting both front and side views, with knee joint extended and flexed to as near right angles as possible. These can be taken by disrobing and

Cut N 27.

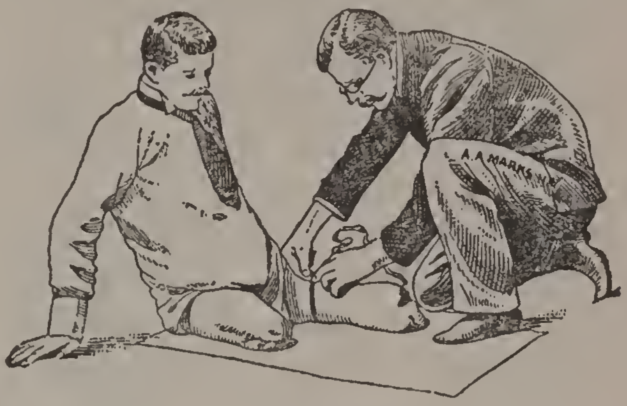
Cut N 28.

sitting on a piece of paper with the stumps extended and marking around them from body to the ends with a pencil held perpendicularly (see Cut N 27). Then turn to one side so that the exterior surface of the thigh and stump will rest on the paper; the stump extended, mark around the thigh and stump, then bend the knee to about right angles and mark around thigh and stump (see Cut N 28). A similar diagram must be made of the other thigh and stump (see Cut N 29). After these diagrams have been made, circumferences should be taken by passing a tape line around each thigh, close to the body, and repeating at points of about two inches apart until the thighs and stumps have been measured. Care should be given to take the measurements when the stumps are not swollen and to draw the tape line moderately tight, as shown in Cuts N 30 and N 31. Write all the measurements in plain figures in their respective places on the diagrams. Sit on

the floor, with back against the wall, and mark, by book or square, the distance from the top of the head to the floor, as illustrated in Cut N 32. Send this measurement, together with former height,



Cut N 29.



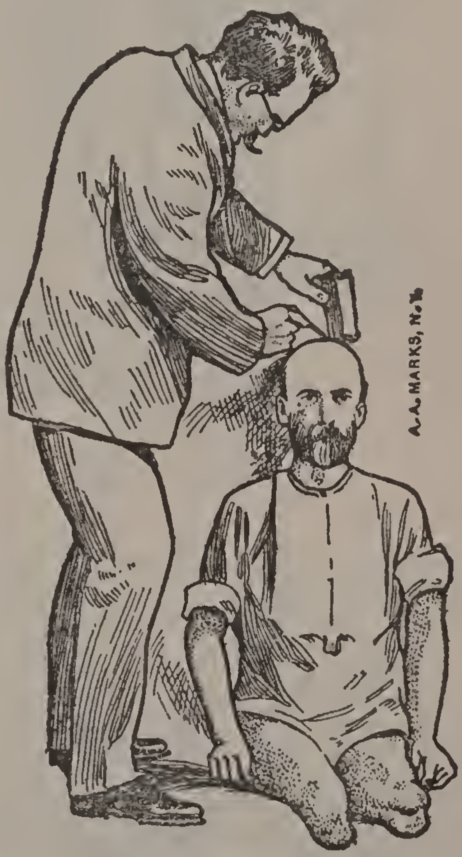
Cut N 30.

that is, the height before amputation. If the full former height is to be restored that fact should be noted.

Stumps that reach to the ankle joints or knee joints should be reproduced in plaster.

The following questions should be answered in every case: Name of patient? Post-office address? Occupation? Age?

Cut N 31.



Cut N 32.

Weight? Cause of amputation? When was the amputation performed? Which leg amputated? Has an artificial leg been worn? For how long? Name of the party ordering the leg? His address? Is the leg to be made and fitted from measurements in the absence of the patient?

If it is proposed to take weight on the end of the stump, that fact should be noted.

If the amputation is in the ankle joint or in the foot, the diagrams and measurements are the same as are required in amputations above the ankles.

Plaster Casts.—Plaster casts are only required of stumps that reach to the articulations (knee or ankle joints) or in the feet, and of deformed limbs, and of amputations that have resulted from deformities.

The method of making a plaster cast depends upon the condition of the stump. For tapering stumps, the following is the simplest: Remove the clothing, shave all hair from the stump or fasten it down with paste, or thick soap, as otherwise it will

Cut N 33.

Cut N 34.

cling to the plaster. Then take two quarts of thick, quick-drying plaster of Paris, such as used by dentists, put a quart of water in a bowl and sprinkle the dry plaster in it, mix thoroughly. It should be made about as stiff as "pancake dough;" then spread it over all sides of the stump to the thickness of at least half an inch. The stump must be held perfectly still until the plaster has become hard, which will be about ten minutes. Then draw it from the stump and the inside will be a counterpart of the stump.

If the stump is larger at the end than immediately above, as in the case of partial foot, ankle-joint, or knee-joint amputations, the plaster must be broken off in large pieces and put together after the stump is removed, or the string method can be used, as follows: A piece of strong, thin cord is passed loosely up each side of the limb (see Cut N 33), to which it is made to adhere

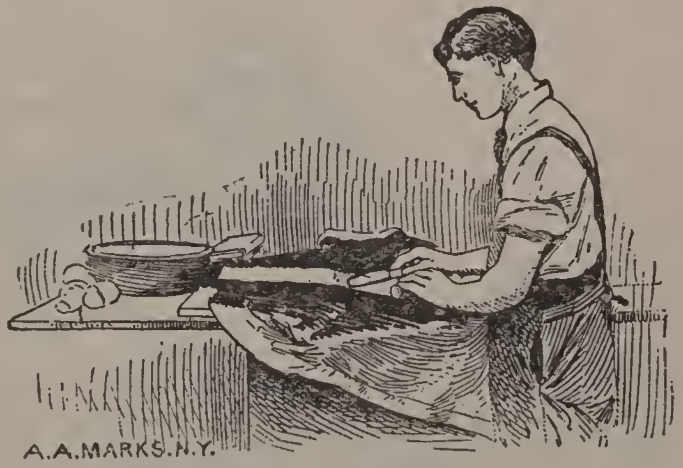
by thick plaster (see Cut N 34). Work quickly, using about four quarts of slacked plaster and cover the entire limb to a thickness of not less than half an inch. As the leg must be held vertically,

Cut N 35.

Cut N 36.

the plaster must be quite thick, otherwise it will flow down. Every part, the back, sides, front, and end, must be liberally covered. As soon as the plaster has become a little set, the string can be

Cut N 37.



Cut N 38.

pulled gently downward (see Cut N 35), cutting the mold into longitudinal parts. It must now be left alone, so as to thoroughly harden, which will take about ten minutes; the mold can then be

separated on the line cut by the string and the two parts removed (see Cut N 36). These parts can then be greased or oiled on the inside and put together and bound with a string; the inside can then be filled with thin plaster of Paris (see Cut N 37). When the mold is filled, it should be laid aside for several hours, when it will have become so hard that the shell will yield to slight pressure and break off, uncovering a facsimile of the stump.

Cut N 39.

Cut N 40.

The plaster bandage method is an excellent way of taking a cast of a flabby and tapering stump. A sheet of old muslin or cheesecloth is cut into strips about two inches wide and sewed into lengths of about twelve feet long. Three such strips are usually needed. Dry plaster should be spread on the strips which are then rolled up very tightly (see Cut N 38). No more plaster

Cut N 41.

should be put on than will fill the meshes. The stump should be prepared by removing the hair or fastening it down with paste or thick soap. The plaster bandage roll must be immersed in water and allowed to remain until the bubbles cease to come to the surface (see Cut N 39). It is then taken from the water and wrapped around the stump while being unrolled, beginning at the end of the stump and continuing to a little above the knee

(see Cut N 40), then work down and up again, covering the stump with three or more layers or until all the bandages have been used. Allow the bandage to remain on the stump until it becomes hard, when the stump can be withdrawn (see Cut N 41). The plaster bandage will form a mold of the stump, which can be sent to us as it is, or it can be greased and filled with slacked plaster, and a true cast made, as previously described.

Casts and molds should be sent packed in sawdust to prevent breakage. If shells are sent, they must be filled with sawdust, to prevent collapse in transit.

Prices for artificial legs, feet, etc., will be found in chapter placed at the back of this book. These prices are subject to change according to changes that take place in costs of material, labor, etc.

ACCESSORIES.—Needful supplies, as indicated below, are furnished without extra charge.

Artificial Foot for partial foot or ankle-joint amputation. A suitable sock for the stump.

Artificial Leg for below-knee amputation. A suitable suspender, one long and one short stump sock, screwdriver and lubricant for knee joint.

Artificial Leg for all other amputations. A suitable suspender, one sock for stump, lubricant for the knee-joint, screwdriver, extra spring.

TERMS OF PAYMENT.—Payment should be in advance with every order. If preferred, one-half can be advanced and the balance paid on delivery. This is the plan on which payments are reasonably and properly required on all articles that are made to order.

GUARANTEES.—A guarantee for a period of five years covering material and construction is given with each leg.

CHAPTER XVI

WHEN EXTREME CONSERVATISM IN AMPUTATIONS BECAME A MENACE

By GEORGE E. MARKS, A.M.

Amputations are made to save life, relieve pain, or to detach a useless member. Trauma, disease, neurotic afflictions, paralysis and deformities come within the list of causes.

For years the thought that amputations should be made with the least sacrifice governed the operations of the surgeon, and so deeply has this been welded into text books, that even to-day prothesis is too frequently ignored and long troublesome stumps the sequence.

Fig. 1

I was requested by the late Dr. J. MacDonald, Jr., to prepare an article in which the errors of excessive conservation might be presented to the readers of the American Journal of Surgery. I prepared the article and it appeared in that journal, September 1907. That article was extensively quoted. Although seventeen years have elapsed it is still received with favor by the profession and frequently referred to and copies are sought.

I have taken the liberty of revising that article and am now distributing it with the hope that it will modify the practice of "least sacrifice," and encourage an aim for stumps of the most efficient capabilities.

The cases cited below are actual, each has been under my observation.

No. 1. Oscalcis partly removed, all other bones of the foot remaining. The oscalcis is required to hold the Tendo-Achilles. As soon as that fastening is destroyed, or its power weakened by shortening the "lever," the ankle joint ceases to function with strength sufficient to elevate the body, in consequence walking is proportionately impaired.

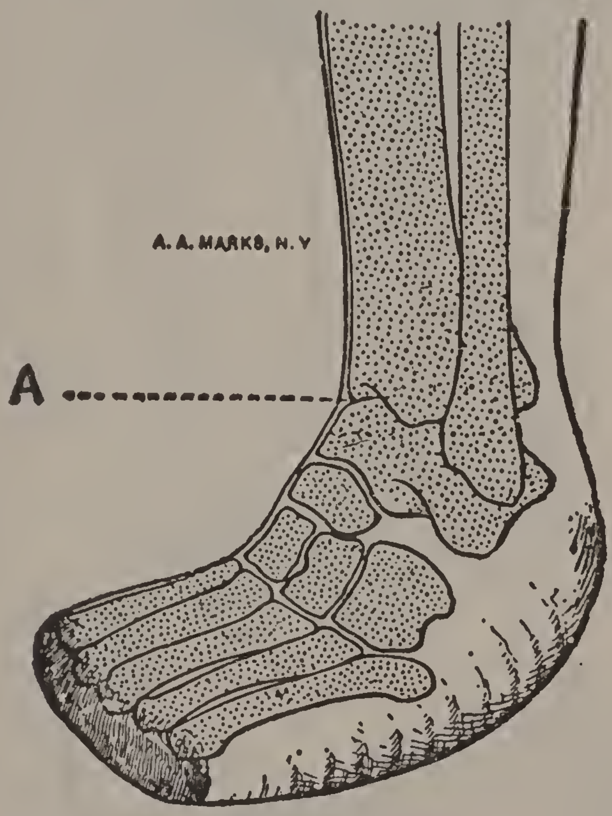


Fig. 2

The operation damaged the protective tissues of the heel, preventing impact with any medium calculated to fill the heel part of a shoe. The only appliance I could devise was an encasement for the foot, carried well up on the leg, allowing the weight to be applied to the ball of the foot. This appliance was somewhat cumbersome, not very shapely and, in order to have the required strength, was unavoidably heavy. Amputation of the foot at the ankle after the Symes method would have brought more comfort, more efficiency and less expense to the subject. If heel flap was doubtful, amputation at point of election A-A would have been better.

No. 2. Foot lacerated, bones crushed. The surgeon removed the front part of the foot and the entire oscalcis. The prospect of equipping this person with a helpful artificial foot was problematic. It was, however, accomplished with indifferent results compared with those that would have followed if the amputation had been at the ankle Symes or Pirogoff A-A.

No. 3. An amputation at the instep, back of the flexor fastenings will put the ankle entirely under control of the Tendo-Achilles, when this tendon is not opposed, the heel will be drawn out of place. The severing, or lengthening of the tendon is only a temporary expedient, sooner or later the tendon will unite or shorten, and influence the heel away from the place at which it can support weight. If the flexors cannot be saved and function it is better to amputate in the ankle joint. Line A after the Symes or Pirogoff methods.

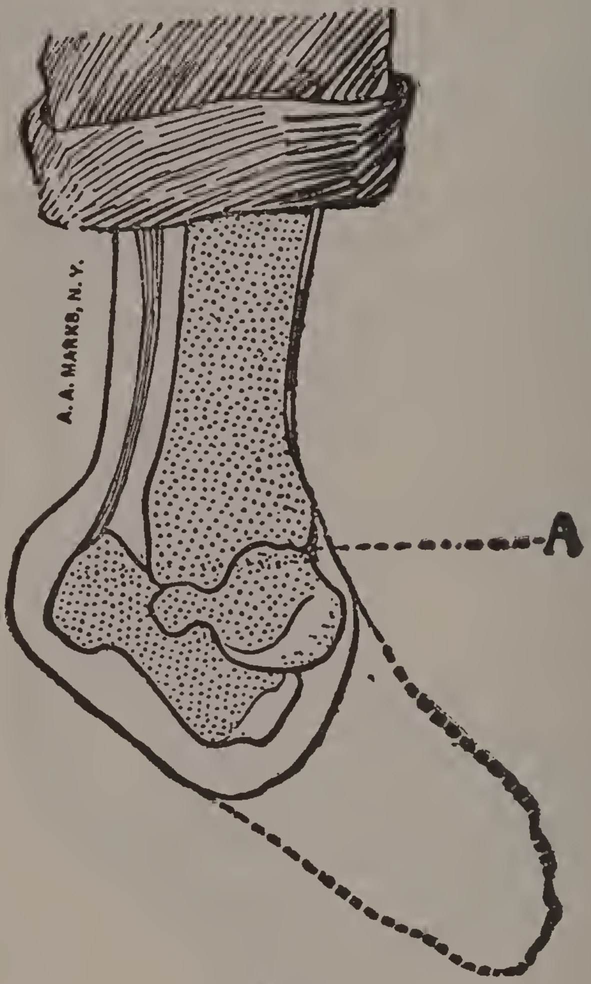


Fig. 3

No. 4. An amputation in the foot removing all the bones, with the exception of the Astragalus. I have never known good results to follow an operation of this kind unless the Astragalus is fixed and covered by a substantial heel flap. An articulating Astragalus no matter how well it may be protected by flap is not productive of the good results. It is safer and better to amputate at the ankle after the Symes or Pirogoff method.

No. 5. An amputation of the foot very close to the ankle articulation is not well advised. The tiba at the ankle, is very small and very poorly protected by tissue and circulation is easily interrupted. Pressure at the popliteal area will invariably conjest or impoverish the end of a long stump. An amputation at the point of election on line A-A is much to be preferred.

No. 6. Failure to remove a little additional tissue at the sides of a long stump, especially in ankle joint amputations will result in

puckerings of the tissue on the sides. These fleshy protuberances are easily irritated, they rub against the inner walls of the socket of the artificial leg. If pockets are provided the limb is bulky to an objectionable degree.

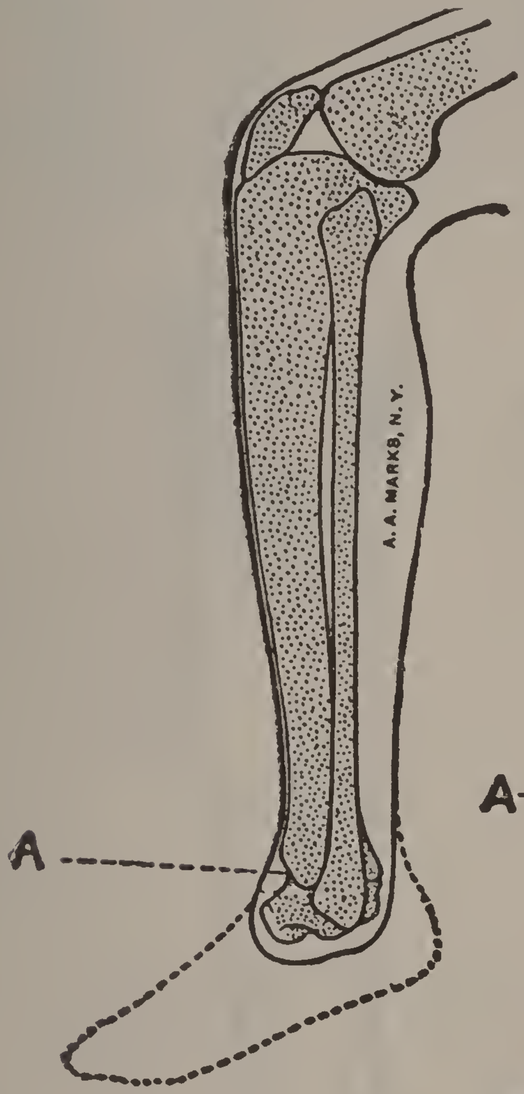


Fig. 4

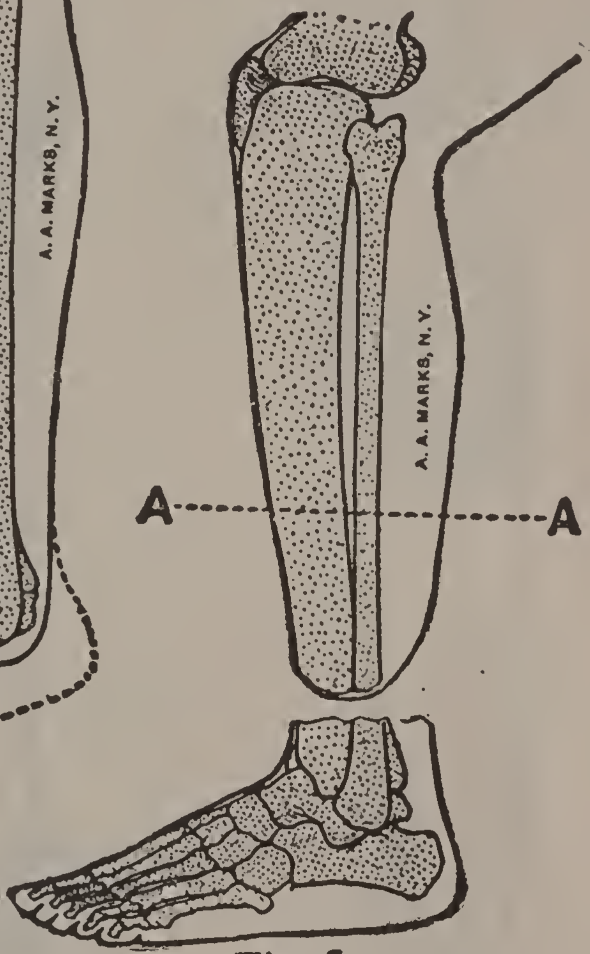


Fig. 5

No. 7. It is wise to amputate well away from lacerated parts. The importance to save a part of the foot is not great enough to justify the retention of doubtful tissue. Stumps reaching to the ankle joint, in order to be end-bearing must be covered with healthy well-nourished tissue. Better remove the entire foot and produce an end-bearing stump after the Symes or Pirogoff methods, line A-A, than take a chance on saving a part of the foot when the covering tissue is questionable.

No. 8. The main object in amputating at the ankle joint is to produce an end-bearing stump on which the patient will be able to rest his entire weight, and unless this is obtained the amputation had better be made at the point of election in the leg. An end-bearing stump must have a healthy, well-cushioned flap, without cicatrix on the parts required to bear weight. In a typical Symes or Pirogoff amputation the cicatrix is always laterally across the front

a little above the end, but in some modifications, the cicatrix is placed across the end directly on the surface where weight is to be applied. It is rare that a cicatrized surface becomes strong enough to endure weight or pressure. The removal of the foot at the ankle, or a part of the foot at the instep, is a mistake if the flap must be of such a character as to cause suffering under pressure. Better amputate at point of election line A-A.

No. 9. It is not wise to amputate below an involved part; a long stump is not of enough importance to take the risk. Fig. 8 shows an amputation at the ankle on account of elephantiasis. It was

Fig. 6

Fig. 7

assumed that, by removing the foot, the disease would disappear from the leg, undue importance being given to a long stump. The patient suffered for several years, wearing an artificial leg of unsightly proportions. Finally, despairing of improvement by nature's operations the leg was amputated at the point of election shown by A-A. This party has gotten about conveniently with an artifical leg of shapely lines for many years.

No. 10. In amputating a leg, care should be exercised in removing as much of the fibula as of the tibia. Occasionally in a comminuted fracture the ends of the broken bones are but slightly trimmed, and if the fracture of the tibia is above that of the fibula, the fibula will be left too long. Unfortunately the fibula will not hold tissue as well as the tibia and when an artificial leg is worn, the end of the fibula becomes denuded.

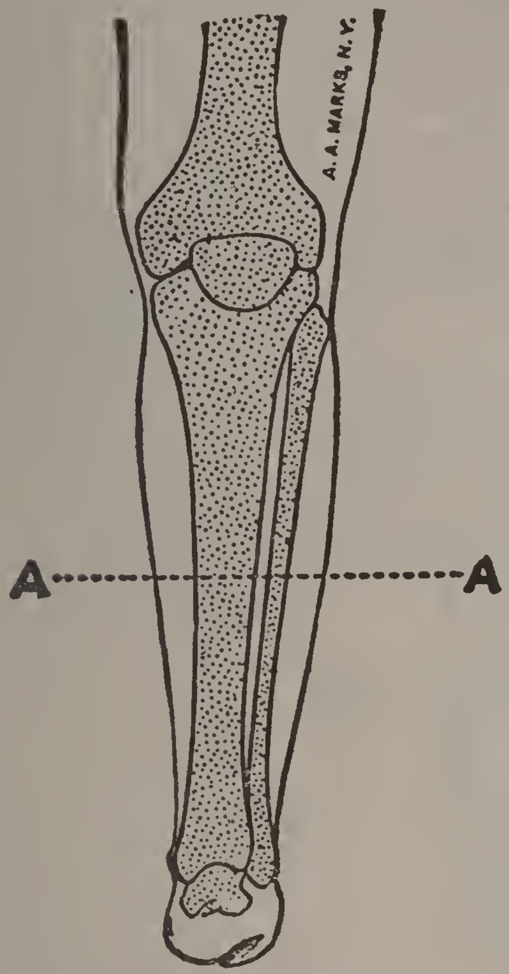


Fig. 8

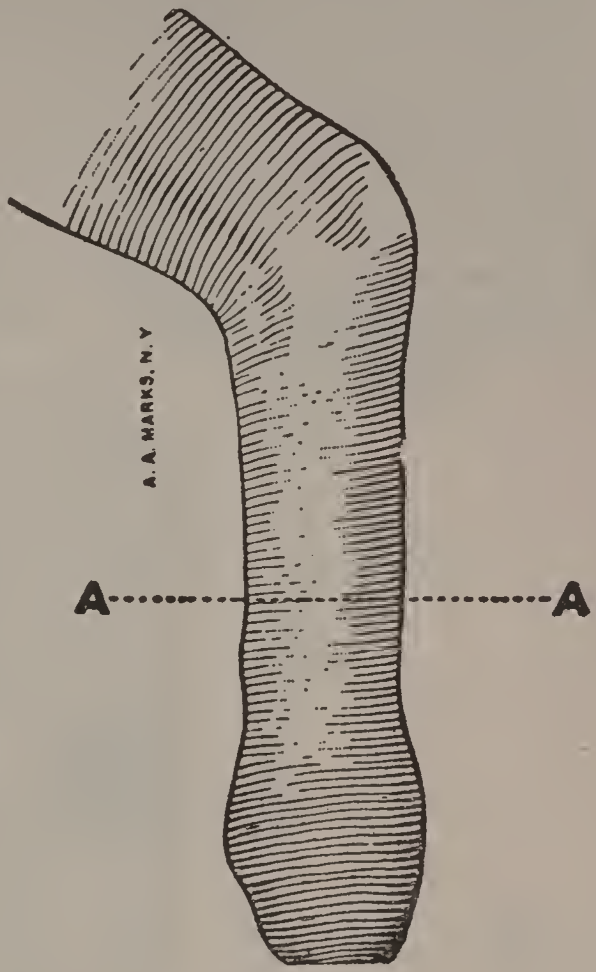


Fig. 9

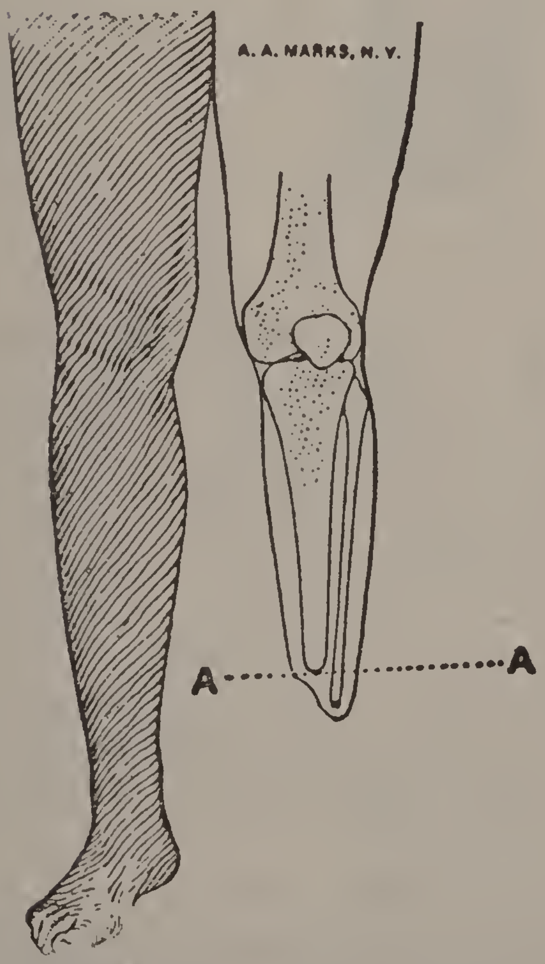


Fig. 10

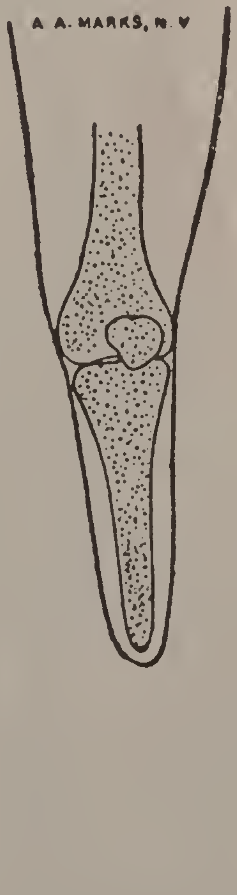


Fig. 11

No. 11. The fibula is sometimes removed in its entirety, since it can perform no function whatever in operating an artificial leg, its absence is not to be regretted, but its removal leaves a cicatrix running the entire length of the external aspect of the stump, which is more of an objection than the presence of the bone.

No. 12. The importance of amputating above an injured or lacerated part may be instanced by reciting the case from which fig. 12 was sketched. The client was treated for a number of years for necrosed tibia. The bone had been scraped, and every effort

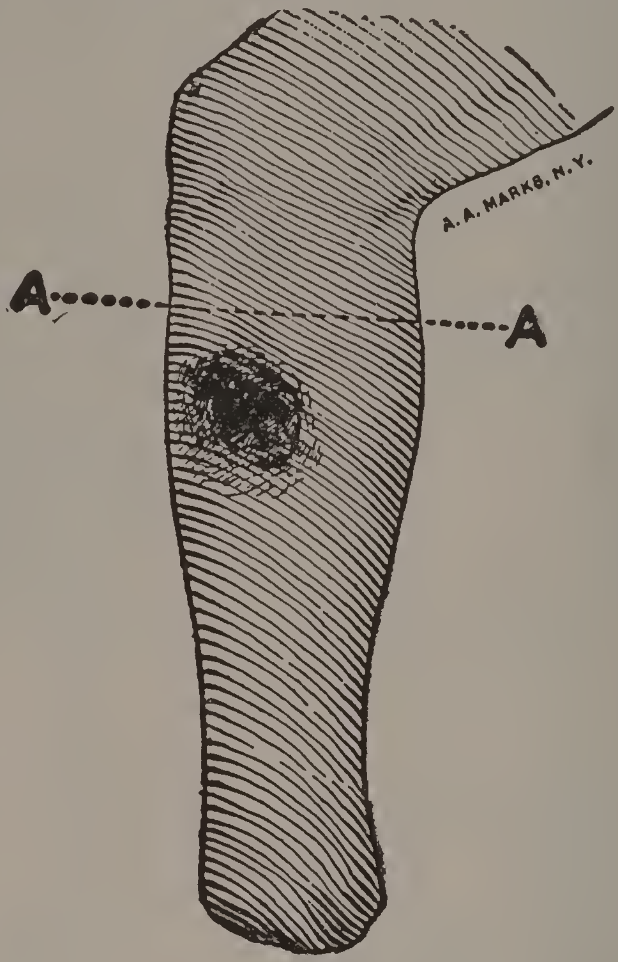


Fig. 12

made to grow periosteum and tissue. Years passed with no results. The young man met with an accident that crushed the foot of the same leg, necessitating amputation. The fact that the necrosed tibia had for years been a source of suffering and solicitude was entirely ignored, and the amputation was made at the ankle joint. An artificial leg was applied and worn for several years, but the diseased tibia continued to give trouble, refused to heal and at times caused intense pain. Finally the client decided to get rid of the annoyance, had the leg amputated above the affected part. In a month's time the stump was healed and an artificial leg was applied, the client got about in the most comfortable and advantageous way. He has had no trouble since.

While stumps reaching to the ankle articulation or to the point of election are desirable, yet they are not so important as to justify doubtful experiments which may mean years of suffering and expense. As a matter of fact, a stump having four or more

inches of tibia is capable of controlling the knee joint of an artificial leg and may be said to be long enough.

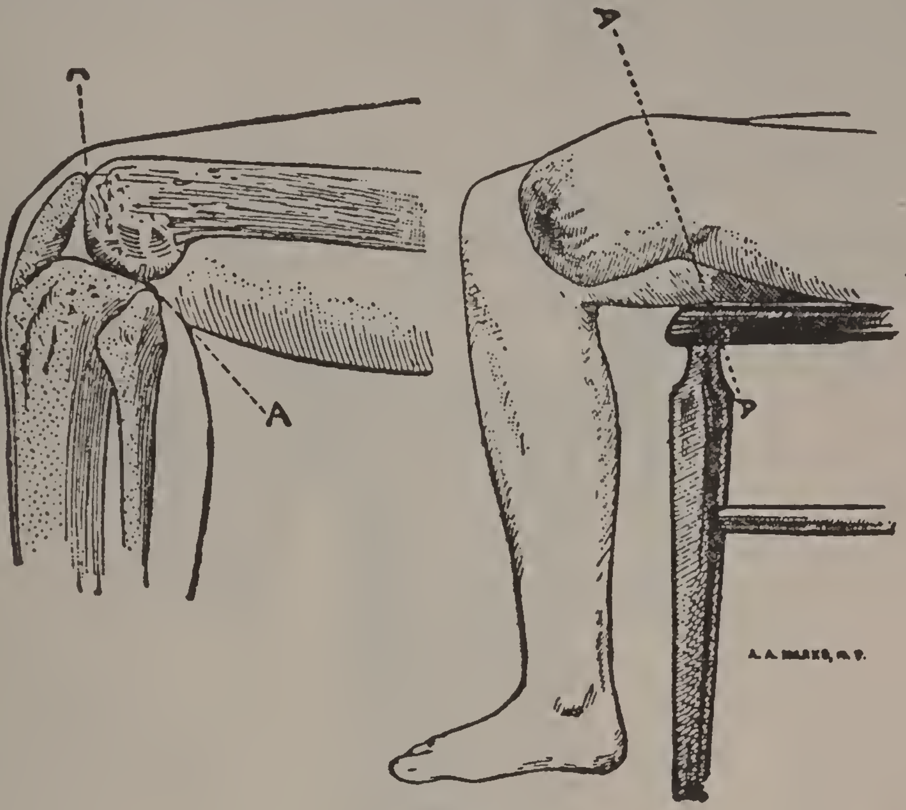


Fig. 13

No. 13. Amputation should not be done at any point below the knee when that joint is ankylosed, whether in flexion or extension.

Fig. 14

If there is no reasonable chance that mobility of the knee joint can be restored, the amputation should be in the knee articulation.

All that is left of the stump below the knee can be of no use in operating an artificial leg. The articulation of an artificial knee should be on a line with the articulation of the natural. Therefore, if the amputation is done below an ankylosed knee there will necessarily be a conspicuously elongated thigh if at extension; and in case of ankylosis in flexion, the stump will protrude from the back of the thigh of the artificial leg. The leg of the trousers must therefore be very wide and unsightly in order to cover the artificial leg and bent knee.

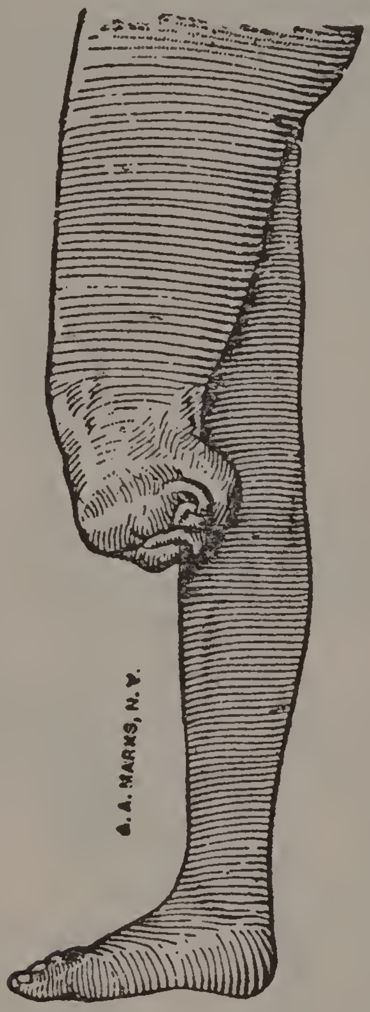


Fig. 15

No. 14. After amputation through the leg there is a very strong tendency for the knee joint to contract, lessening the range of motion. To avoid this, the patient should be required to flex and extend the knee joint frequently after the stump has healed, and if a slight contraction has taken place, a little additional tension should be applied by the hands to urge further extension.

Contracted hamstrings usually relax under the influence of an artificial leg, but this change in the knee calls for a corresponding change in the artificial leg, all of which can be avoided by a little precaution at the right time.

No. 15. Tissue flaps can be too many,—deep folds of tissue require care to keep them clean, they become receptacles for effete matter from the skin, and dust working through the clothing, causing irritation (fig. 15). Flaps should be as few as possible and should provide smooth surfaces to the stump.

No. 16. In the amputation of both legs, either above or below the knees, it is an error to sacrifice stump (above the point of election), in order to have both the same length (fig. 16). It

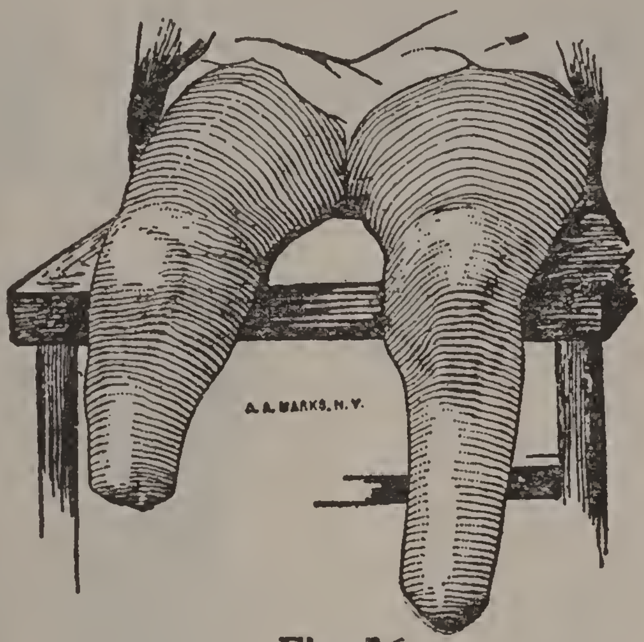


Fig. 16

is possible to have one stump too long and the other too short, but this is no reason why one stump should be made short because the other has to be. Artificial legs can be adapted to stumps of any

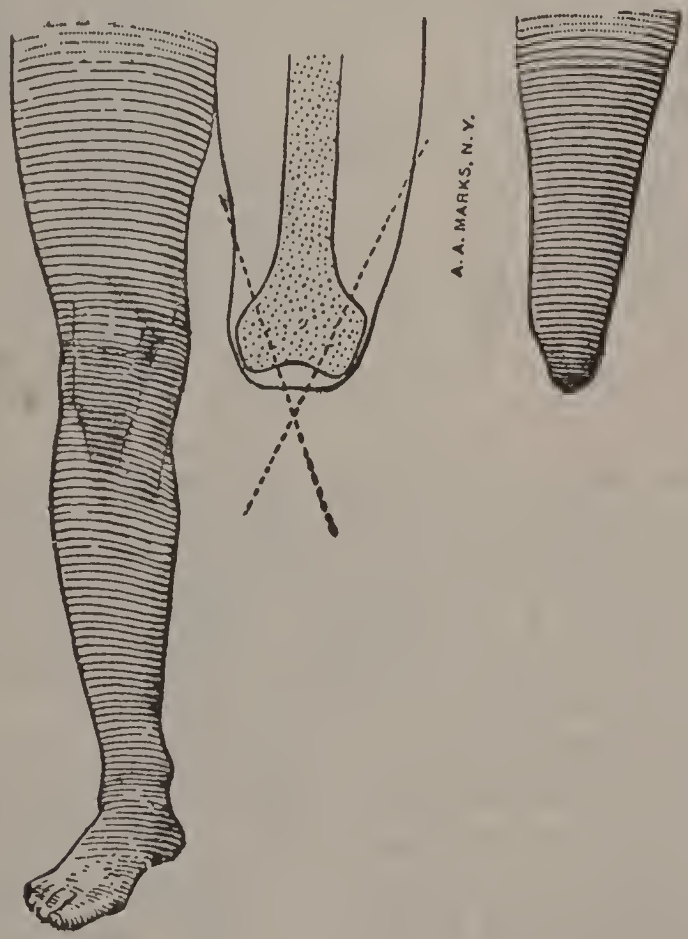


Fig. 17

length and it is a matter of no consequence if there is a difference in length, neither should be below the point of election unless it can be at the ankle after Symes or Pirogoff methods.

No. 17. It was customary in former days to remove the condyles of the femur in a knee joint amputation (fig. 17). This practice, however, has drifted into disfavor and it will be fortunate when all surgeons will look upon it as undesirable. The condyles of the femur afford means for holding an artificial leg in place without resorting to shoulder suspension. A knee joint stump with the condyles present is preferable to a stump tapering from the perineum down. The presence of the patilla in the inter-condyllar space is desirable provided it is firmly united. A movable patilla is troublesome.

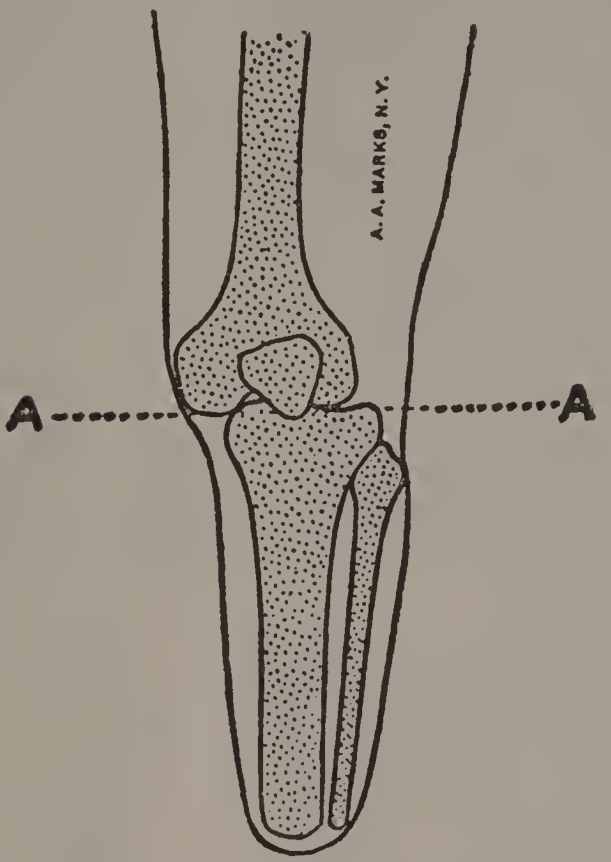


Fig. 18

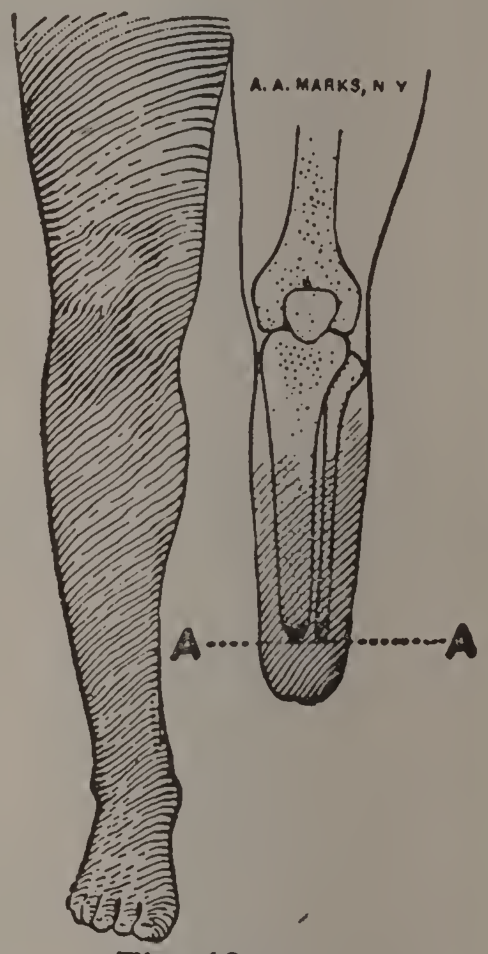


Fig. 19

No. 18. If the bones at the knee joint are hopelessly displaced, laterally or otherwise, and an amputation is necessary to remove a diseased or crushed foot, it had better be in the knee articulation. Otherwise the dislocated knee having its functions impaired, will fail in operating the knee articulation of an artificial leg and the wearer will be at great disadvantage (fig. 18).

No. 19. Redundancy of tissue on the end of any stump is a source of annoyance, and should be avoided. A mass of tissue hanging from the end without muscular control, will flop about, striking the sides of the socket of an artificial leg and become troublesome (fig. 19). An effort should be made to have only enough tissue to cover the end of the stump substantially.

No. 20. After the stump has healed, it should be bandaged and kept so until an artificial leg is applied, otherwise it will take on temporary growth (fig. 20). Adipose tissue or edema will form very

quickly and cause complications if not prevented. As soon as an artificial leg is applied and worn, atrophy is induced, and a large

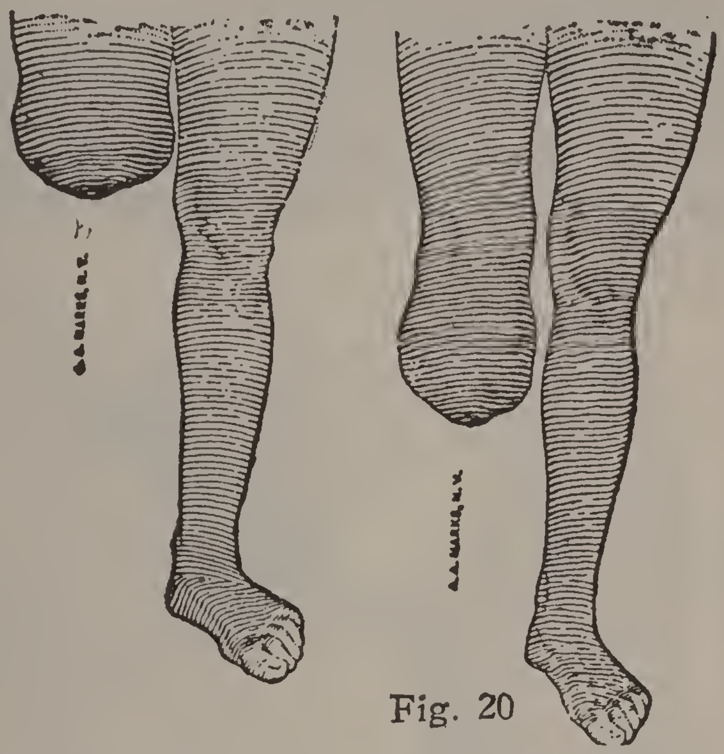


Fig. 20

flabby stump will reduce considerably, necessitating either a new fitting in the artificial leg or filling up of the old socket,—all of which may be avoided by using tight bandages.

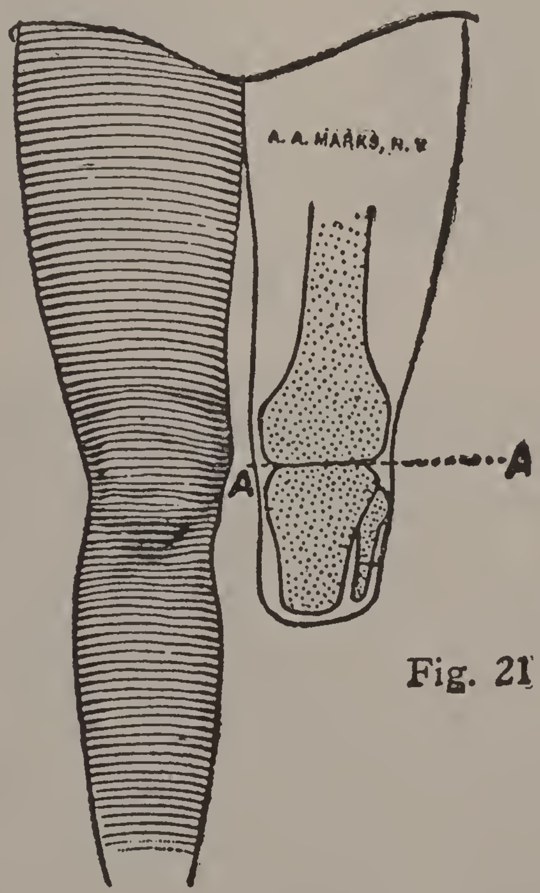


Fig. 21

No. 21. An amputation below the knee with excised knee joint is unfortunate. The excision of the knee in this case was made

for a pathological condition, and the amputation through the tibia was done subsequently on account of traumatism. Why the surgeon amputated through the tibia, instead of through the knee is evidence of the error of extreme conservatism.

No. 22. Amputation may be made at the hip joint, with the femur disarticulated, or a very little of it left, thus providing no stump, or one so short as to be unavailable. A person thus amputated is not necessarily a subject for crutches the rest of his life. The pelvic socket artificial leg recently devised, meets the requirements of such cases.

Fig. 22

The excision of the knee joint to remove diseased parts and uniting the bone of the leg with the femur is in my judgment an unwise procedure. This conclusion is based on the experiences of several of my clients. Mr. S. of Bluefields, W. Va., had a diseased knee. He came to New York with the intention of having his leg amputated above the knee. Dr. P. a prominent surgeon took the case with the intention of amputating. During the process he changed his mind and made an excision of the diseased knee, uniting the bones of leg and thigh, believing that he was doing a good service for the patient. The patient recovered, returned home but regretted that an amputation had not been made, inasmuch as he was very much inconvenienced by the presence of the natural leg which was three inches shorter than the other and stiff at the knee. He endured this inconvenience for about three years, he then submitted to an amputation and has since worn an artificial leg to advantage; re-

gretting that an amputation had not been made as originally intended.

Another case, Mr. DeV. of New York City, met with an injury in the knee joint resulting in the excision of the joint. The doctor united the bones, so the leg was placed at an angle with the thigh. Mr. DeV. went about for many years limping perceptibly at every step. He finally concluded that he would prefer an artificial leg and had an amputation in the thigh. He was not disappointed with results, and never regretted the second operation.

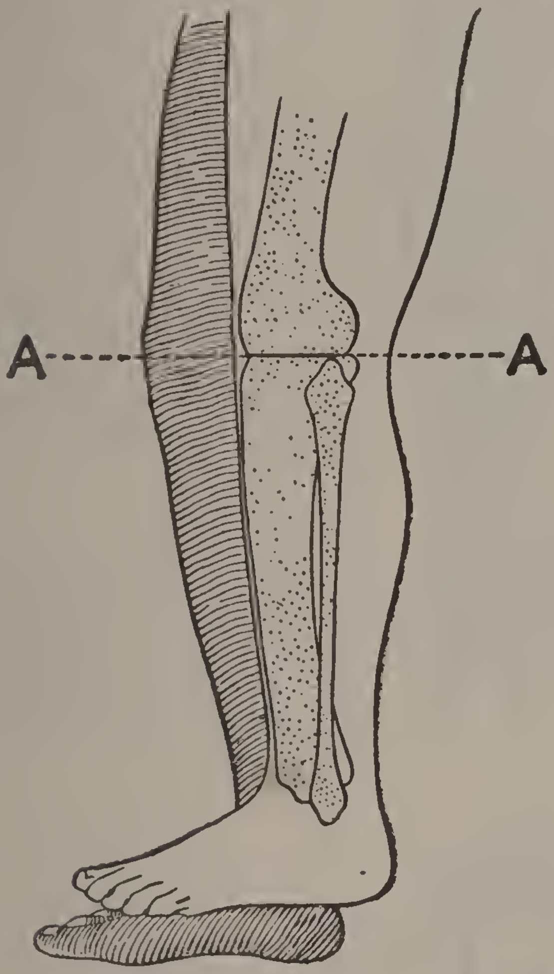


Fig. 23

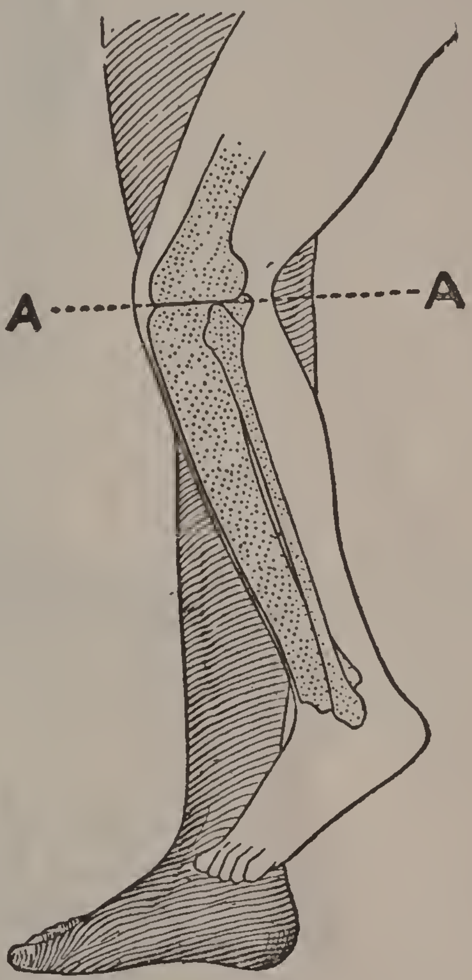


Fig. 24

Illustration No. 25 represents a case where conservatism was justified but nevertheless resulted in a failure. The subject had his left leg badly mangled by a railroad accident. The femur was fractured, foot and part of the leg crushed. Amputation was performed about 4″ below the knee joint. The fractured femur was treated in the usual way with the expectation that the bone would unite, but unfortunately a union was not obtained, and several efforts to bring about one were unsuccessful. An artificial leg was applied but when worn the fractured bones would rub against each other and cause irritation and much suffering. The artificial leg was provided with a substantial thigh corset for the purpose of acting as a splint to the fractured bone. An artificial leg was worn for a number of years, but there was much suffering on account of the ends of the bone not being held in apposition. After a period the subject decided on an amputation, which was made close to the

fracture. An artificial leg was applied and has been used for many years with great success.

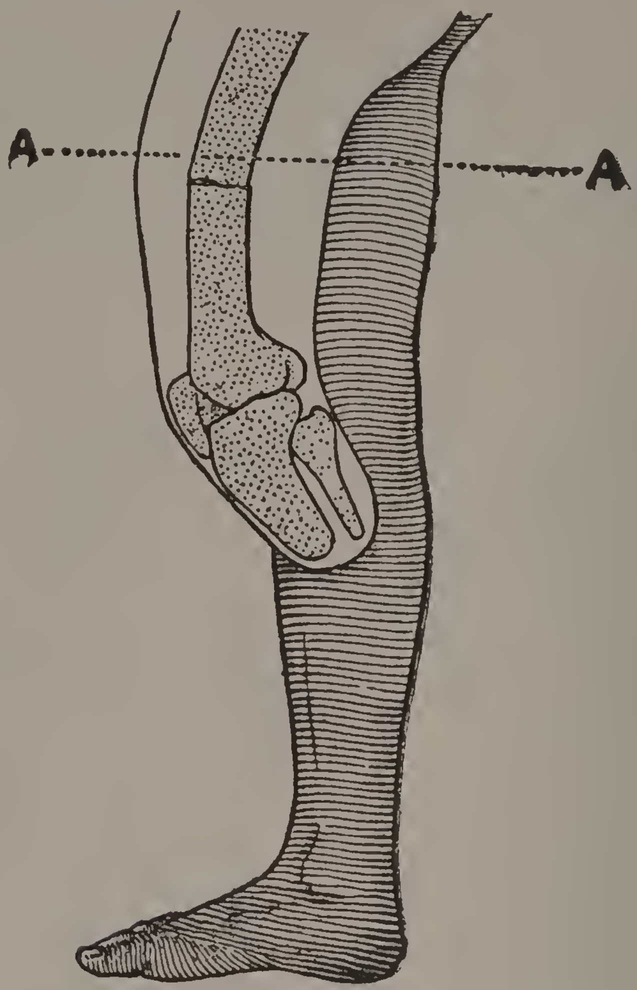


Fig. 25

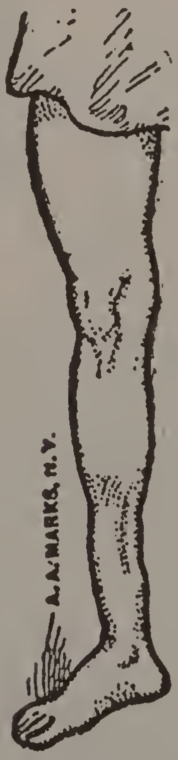


Fig. 26

Conservatism in surgery is sometimes carried to a point that justifies reproach. The removal of several inches of the tibia, then healing the wound, leaving the fibula as the sole support, is

one that cannot be too greatly condemned, yet this incredible thing is being done in these advanced times (fig. 26).

To enable the subject to walk, an encasement is required to receive the leg from the knee down, including a part of the foot. The appliance serves fairly well but the client is never able to walk and get about as well and as free from annoyance as if the amputation had been at the point of election.

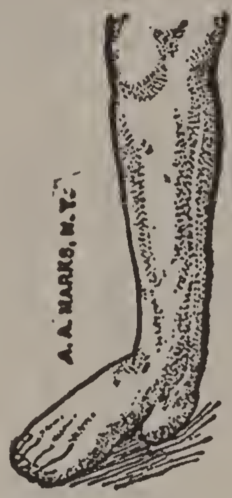


Fig. 27

The removal of the foot in the deformity case shown in fig. 27 would have been more advisable than its retention, the tarsus being united to the fibula. An artificial leg would have been much more beneficial and comfortable than the encasement that was worn.

Fig. 28

Illustration 28 represents a case of infantile paralysis. The client long objected to amputation and carried a very ugly foot for many years. He walked on the side of the foot as in Talipes Varus and suffered much from corns and ulcers. Despairing of relief, he finally submitted to amputation. The leg was removed at the point of election and the subject has since worn an artificial leg to advantage and free from suffering.

Finally, I wish to take this opportunity to express my opinion, based on repeated observation, that the resection of the Astragalus and Oscalcis, and the union of the Cuboid and Scaphoid with the tibia and fibula (fig. 26) produces as bad conditions as exist in talipes equinus and that the Wladimiroff-Mikulicz operation, therefore, cannot be favorably considered by the orthopidist or prothesist.

No person can stand or walk any length of time on the limited surface of the ball of the foot; that part will soon develop corns or ulcers. It must be remembered, too, that the operation elongates the leg two or more inches, necessitating an appliance for the

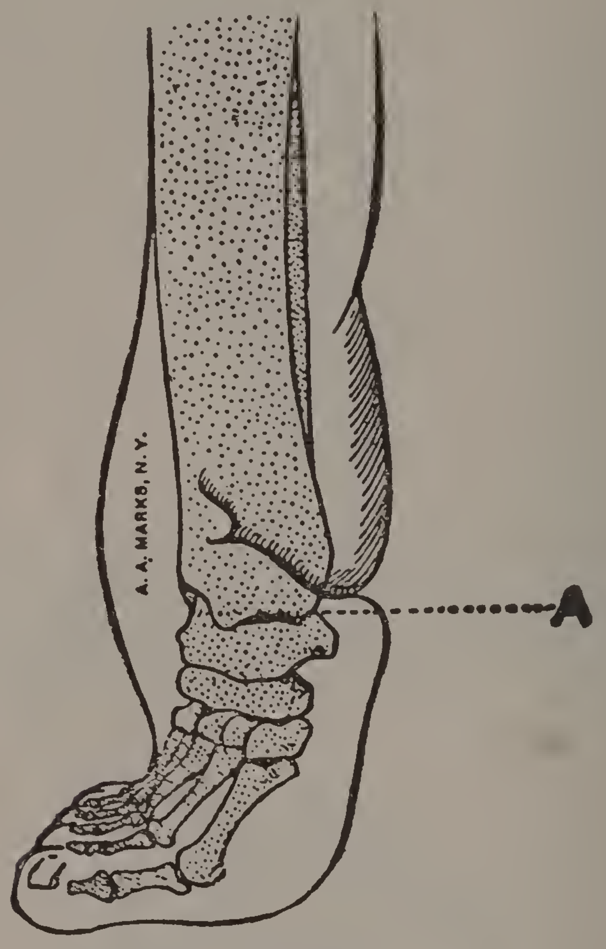


Fig. 29

opposite foot to bring about an equality in the lengths of both. The expense of two appliances, one for the foot that has been operated on, and the other for the opposite, is much more than the cost of an artificial leg.

It is better to amputate at the ankle, if a heel flap can be obtained, and, if not, at the point of election in the leg. The patient will fare much better with an artificial leg.

An artificial leg cannot be applied too soon after the stump is healed in traumatic cases. Waiting entails a loss of time, and permits a stump to become flabby and enervated from inactivity.

The presence of a stubborn sinus on the end of the stump is not necessarily a reason why an artificial leg should not be applied. As a matter of fact, the wearing of an artificial leg puts no pressure on the end of the stump, which (except in disarticulations) practically hangs in space. In wearing an artificial leg, the stump is

stimulated by the work it is performing, the circulation becomes more active and in a great many cases a stubborn sinus is induced to heal substantially and permanently.

Many deformity and paralytic cases where surgeons could greatly improve matters are presented in other parts of this book.

CODE

FOR ORDERING ARTIFICIAL LEGS OR ARMS BY CABLE OF A. A. MARKS, 702 BROADWAY, NEW YORK, N. Y.

A message may be coded and cabled provided it consists of words that are pronounceable and do not contain more than ten letters each.

This code is based on consonants. Vowels a, e, i, o, u, w, y, are only used to form words.

Two letters are used to represent a sentence for example: Bz, means Right leg amputated below knee; Fc means For a man; Ds means Make Strong. These three couplets put togther Bzfcds do not make a word that is pronounceable. By introducing vowels (u, a and e for example), we turn the three couplets into the word Buzfacdes, which is pronounceable and which means by the Marks Code, Right leg amputated below knee, for a man, to be made strong. Another example: Fh means, Distance from crotch to floor; Tk means, 30¾ inches; Fhtk is not pronounceable, but by inserting vowels (o and i, for example), it becomes Fohtik which is pronounceable and means, Distance from crotch to floor is 30¾ inches.

The selection of vowels is purely optional; they are only used to make words pronounceable and it is immaterial what vowels are used or where they are placed as long as the word is made a pronounceable one of not more than ten letters.

INSTRUCTIONS

First—Take all the measurements and diagrams and answer all the questions called for on Marks' order sheet. The same as if you intended to order by mail.

Second—Prepare the Code Message by selecting the couplets in "Code for Specifications," under Section 1; thereby indicating the type of artificial limb needed.

Third—Select the couplets indicating only the essential points on the sound and amputated limbs where measurements have been taken.

Fourth—To each of the above couplets add the couplet that represents the measurement in inches.

You now have a string of consonants. Introduce any of the vowels between the consonants, anywhere, so they will form pronounceable words of not more than ten letters each (including the vowels). Attach your signature and forward by cable. The message can be addressed, "Artificial" New York, which is our Code address.

The complete measurements and diagrams you have taken should be sent immediately by mail together with a draft covering the cost of the limb. Immediately upon receipt of the cable message we will start the construction of the limb you require, and by the time it is finished the measurements and diagrams which you will have forwarded by mail will reach us. We will then make comparison and if everything is to our satisfaction, the limb will be forwarded immediately.

We want the measurements, diagrams and answers to questions for record purposes and future reference.

Note that in the message coded we do not require all the measurements called for on the measuring sheet; only those that can readily be seen as essential.

Artificial limbs for partial feet and partial hand amputations and those that are required to meet unusual conditions should not be ordered by cable. Diagrams in such cases are necessary and they must be forwarded by mail.

After the Coded Message is prepared, it will be well to translate or de-code it, thus you can prove your work.

Cable Address—ARTIFICIAL, NEW YORK.

Mail Address—A. A. MARKS, 702 BROADWAY,

New York, N. Y., U. S. A.

SECTION I

CODE FOR SPECIFICATIONS

Bb — Right hip joint amputation, no tissue protruding, amputated surface even with pelvis.
Bd — Left hip joint amputation, no tissue protruding, amputated surface even with the pelvis.
Bc — Right hip joint amputation, tissue or muscles stump hanging down from the pelvis.
Bf — Left hip joint amputation, tissue or muscle stump hanging down from the pelvis.
Bg — Right leg amputated in the thigh below the hip and above the knee.
Bh — Left leg amputated in the thigh below the hip and above the knee.
Bk — Right leg amputated in the knee joint, condyles removed, end of the stump capable of bearing weight.
Bl — Right leg amputated in the knee joint, condyles present, end of the stump capable of bearing weight.
Bm — Left leg amputated in the knee joint, condyles removed, end of stump capable of bearing weight.
Bn — Left leg amputated in the knee joint, condyles present, end of stump capable of bearing weight.
Bp — Right leg amputated in the knee joint, condyles removed, end of stump not capable of bearing weight.
Br — Right leg amputated in the knee joint, condyles present, end of stump not capable of bearing weight.
Bs — Left leg amputated in the knee joint, condyles removed, end of stump not capable of bearing weight.
Bt — Left leg amputated in the knee joint, condyles present, end of stump not capable of bearing weight.
Bv — Right leg amputated below the knee, knee bent, weight taken on the bent knee, knee-bearing leg required.
Bx — Left leg amputated below the knee, knee bent, weight taken on the bent knee, knee-bearing leg required.
Bz — Right leg amputated below the knee and above the ankle.
Cb — Left leg amputated below the knee and above the ankle.
Cc — Right foot amputated at the ankle joint, end of stump capable of bearing weight.
Cd — Right foot amputated at the ankle joint, end of stump not capable of bearing weight.
Cf — Left foot amputated at the ankle joint, end of stump capable of bearing weight.
Cg — Left foot amputated at the ankle joint, end of stump not capable of bearing weight.
Ch — Both legs amputated.
Ck — Artificial leg to have a rubber foot without ankle joint.
Cl — Artificial leg to have ankle joint.
Cm — Right arm amputated at the shoulder joint. No stump protruding.
Cn — Right arm amputated at the shoulder joint, a tissue or muscle stump protruding.
Cp — Left arm amputated at the shoulder joint, no stump protruding.
Cr — Left arm amputated at the shoulder joint, a tissue or muscle stump protruding.
Cs — Right arm amputated below the shoulder and above the elbow.

Ct — Left arm amputated below the shoulder and above the elbow.
Cv — Right arm amputated in the elbow joint.
Cx — Left arm amputated in the elbow joint.
Cz — Right arm amputated below the elbow and above the wrist.
Db — Left arm amputated below the elbow and above the wrist.
Dc — Right hand amputated at the wrist joint, styloids removed, producing a tapering stump.
Dd — Right hand amputated at the wrist joint, styloids present, stump larger at the end than above.
Df — Left hand amputated at the wrist joint, styloids removed, producing a tapering stump.
Dg — Left hand amputated at the wrist joint, styloids present, stump larger at the end than above.
Dh — Both arms amputated.
Dk — Artificial arm to go only to the elbow, no joints or upper part required.
Dl — Size of glove to be worn on the artificial hand.
Dm — The artificial arm to have rotation at wrist.
Dn — The artificial arm to have flexion and extension at wrist.
Dp — The artificial arm is to have rotation, flexion and extension at wrist
Dr — The rubber hand to be permanently attached to the forearm admitting of no motion whatever.
Ds — Make artificial limb very strong.
Dt — Make artificial limb very light.
Dv — Make artificial limb from measurements and forward immediately.
Dx — Construct the limb from measurements but do not ship until you receive the measurements forwarded today, and when you receive them verify the code measurements and prove the work before shipping.
Dz — The artificial limb is to be worn by a boy.
Fb — The artificial limb is to be worn by a girl.
Fc — The artificial limb is to be worn by a man.
Fd — The artificial limb is to be worn by a woman.
Ff — The artificial limb is to be worn by an old man.
Fg — The artificial limb is to be worn by an old woman.

SECTION II

CODE FOR PLACES ON THE LIMB AND STUMP WHERE MEASUREMENTS ARE TAKEN

Fh — Distance from crotch to floor.
Fk — Distance from top of knee to floor, bent at right angle.
Fl — Length of the foot.
Fm — Circumference of the thigh of sound leg on line with the crotch.
Fn — Circumference of the thigh of sound leg midway between the crotch and knee.
Fp — Circumference of knee joint of sound leg.
Fr — Circumference of calf sound leg.
Fs — Circumference of ankle just above the joint of sound leg.
Ft — Circumference of heel and instep.
Fv — Circumference of instep.
Fx — Circumference of the foot at the base of the toes or ball.
Fz — Distance from crotch to end of stump.
Gb — Distance from end of stump to the floor.
Gc — Distance from bent knee to floor. Required only when knee-bearing leg is wanted.
Gd — Distance from popliteal space to end of stump knee bent to right angle.
Gf — Circumference of amputated leg on line with crotch.
Gg — Circumference of amputated leg four inches below crotch.
Gh — Circumference of amputated leg eight inches below crotch.
Gk — Circumference of amputated leg twelve inches below crotch.
Gl — Circumference of amputated leg around the knee joint.
Gm — Lateral diameter of condyles or knee joint, amputated side.
Gn — Circumference of stump just below knee cap.
Gp — Circumference of stump four inches below knee cap.
Gr — Circumference of stump eight inches below knee cap.
Gs — Circumference of stump twelve inches below knee cap.
Gt — Circumference of stump sixteen inches below knee cap.
Gv — Circumference of stump at the ankle joint.
Gx — Circumference of waist just above the hips.
Gz — Distance of point of shoulder to tip of elbow sound arm.
Hb — Distance from tip of elbow to wrist sound arm.
Hc — Distance from wrist to end of thumb.
Hd — Circumference of sound arm on line with axilla.
Hf — Circumference of sound arm midway between axilla and elbow.
Hg — Circumference of elbow joint sound arm.
Hh — Circumference of wrist sound arm.
Hk — Circumference of hand at base of fingers under the thumb.
Hl — Distance from point of shoulder to end of stump.
Hm — Distance from point of shoulder to tip of elbow amputated side.
Hn — Distance from tip of elbow to end of stump.
Hp — Distance from bend of elbow to end of stump.
Hr — Circumference of arm on line with axilla amputated side.
Hs — Circumference of arm four inches below axilla amputated side.
Ht — Circumference of arm eight inches below axilla amputated side.
Hv — Circumference of elbow joint amputated side.
Hx — Circumference of stump just below elbow.
Hz — Circumference of stump four inches below elbow.
Kb — Circumference of stump eight inches below elbow.
Kc — Circumference of stump twelve inches below elbow.
Kd — Circumference of stump about the end.
Kf — Circumference of chest.

SECTION III

CODE FOR MEASUREMENTS

Kp — 1
Kr — 1½
Ks — 2
Kt — 2½
Kv — 3
Kx — 3¼
Kz — 3½
Lb — 3¾
Lc — 4
Ld — 4¼
Lf — 4½
Lg — 4¾
Lh — 5
Lk — 5¼
Ll — 5½
Lm — 5¾
Ln — 6
Lp — 6¼
Lr — 6½
Ls — 6¾
Lt — 7
Lv — 7¼
Lx — 7½
Lz — 7¾
Mb — 8
Mc — 8¼
Md — 8½
Mf — 8¾
Mg — 9
Mh — 9¼
Mk — 9½
Ml — 9¾
Mm — 10
Mn — 10¼
Mp — 10½
Mr — 10¾
Ms — 11
Mt — 11¼
Mv — 11½
Mx — 11¾
Mz — 12
Nb — 12¼
Nc — 12½
Nd — 12¾
Nf — 13
Ng — 13¼
Nh — 13½
Nk — 13¾
Nl — 14
Nm — 14¼
Nn — 14½
Np — 14¾
Nr — 15
Ns — 15¼
Nt — 15½
Nv — 15¾
Nx — 16
Nz — 16¼
Pb — 16½
Pc — 16¾
Pd — 17
Pf — 17¼
Pg — 17½
Ph — 17¾
Pk — 18
Pl — 18¼
Pm — 18½
Pn — 18¾
Pp — 19
Pr — 19¼
Ps — 19½
Pt — 19¾
Pv — 20
Px — 20¼
Pz — 20½
Rb — 20¾
Rc — 21
Rd — 21¼
Rf — 21½
Rg — 21¾
Rh — 22
Rk — 22¼
Rl — 22½
Rm — 22¾
Rn — 23
Rp — 23¼
Rr — 23½
Rs — 23¾
Rt — 24
Rv — 24¼
Rx — 24½
Rz — 24¾
Sb — 25
Sc — 25¼
Sd — 25½
Sf — 25¾
Sg — 26
Sh — 26¼
Sk — 26½
Sl — 26¾
Sm — 27
Sn — 27¼
Sp — 27½
Sr — 27¾
Ss — 28
St — 28¼
Sv — 28½
Sx — 28¾
Sz — 29
Tb — 29¼
Tc — 29½
Td — 29¾
Tf — 30
Tg — 30¼
Th — 30½
Tk — 30¾
Tl — 31
Tm — 31¼
Tn — 31½
Tp — 31¾
Tr — 32
Ts — 32¼
Tt — 32½
Tv — 32¾
Tx — 33
Tz — 33¼
Vb — 33½
Vc — 33¾
Vd — 34
Vf — 34½
Vg — 35
Vh — 35½
Vk — 36
Vl — 36½
Vm — 37
Vn — 38
Vp — 39
Vr — 40
Vs — 41
Vt — 42

EXAMPLE

CODE	
Cb	— Artificial left leg amputation between knee and ankle.
Ff	— To be worn by an elderly man.
Ck	— The leg to have a rubber foot with rigid ankle.
Dt	— To be of light construction.
Dv	— To be made as quickly as possible and shipped.
FhTn	— Sound leg from crotch to floor 31½ inches.
FkRh	— Sound leg from top of knee to floor 22 inches.
FlMm.	— Length of foot 10 inches.
FmRl	— Circumference of thigh at body or crotch 22½ inches.
FnPp	— Circumference of midthigh 19 inches.
FpNg	— Circumference of knee joint, 13¼ inches.
FrNn	— Circumference of calf 14½ inches.
FsMk	— Circumference of ankle 9½ inches.
FtNf	— Circumference of heel and instep 13 inches.
FvMd	— Circumference of instep 8½ inches.
FxMg	— Circumference of ball of foot 9 inches.
FzSd	— Distance from crotch to end of stump 25½ inches.
GbLn	— Distance from end of stump to floor 6 inches.
GdMs	— Distance from popliteal space to end of stump 11 inches.
GfPv	— Circumference amputated leg close to crotch 20 inches.
GgNx	— Circumference amputated leg 4 inches below crotch 16 inches.
GhNr	— Circumference amputated leg 8 inches below crotch 15 inches.
GkNc	— Circumference amputated leg 12 inches below crotch 12½ inches.
GlNf	— Circumference amputated leg knee cap 13 inches.
GnMz	— Circumference amputated leg just below knee cap 12 inches.
GpMm	— Circumference amputated leg 4 inches below knee cap 10 inches.
GrMk	— Circumference amputated leg 8 inches below knee cap 9½ inches.

Code couplets representing the above are as follows:

Cb Ff Ck Dt Dv Fh Tn Fk Rh Fl Mm Fm Rl Fn Pp Fp Ng Fr Nn Fs Mk Ft Nf Fv Md Fx Mg Fz Sd Gb Ln Gd Ms Gf Pv Gg Nx Gh Nr Gk Nc Gl Nf Gn Mz Gp Mm Gr Mk.

Introducing vowels and separating into words that can be pronounced and that have ten or less letters in each, the cable message—with address—may be as follows:

Artificial, New York

Cabiffack Dotadiv Fahaten Fakirhofel Mimifamrol Funappif Pingferen Nafsemkof Tonfafvim Dufixmag Fozsadgib Lingdoms Gofpovig Gunexghon Ragknic Glenfagon Mazgopam Migramik.

Signed

CHAPTER XVII

HANDS AND ARMS, NATURAL COMPARED WITH ARTIFICIAL

History.—Artificial hand and arm construction has advanced with that of artificial legs. The modern arm is calculated for general purposes, the ancient had only one object in its design. M. Sergius (167 B. C.), referred to by Pliny, wore an artificial arm, with which he held his shield while in battle, and released Cremona from siege. The artificial arm made for a celebrated tenor of the sixteenth century was used successfully in his histrionic gesticulations; the arm of the celebrated Surgeon Pare, as well as the productions of Lorrain, Sebastian, Bailiff, Verduin, Serre, Wilson, and De Graef, and all the early makers, had but few functions to perform.

There is a strong inclination to the belief that artificial arm construction has retrograded, and that those of modern times are not as useful as those of the early masters. Visitors to European museums, where many of the archaic substitutes are exhibited, are impressed by the profuse and extravagant labels and catalogues, ascribing to the wearers miraculous deeds of valor, performed in battle.

We are in position to state that historic substitutes were useless beyond the specific purposes for which they were designed, and were greatly inferior to those of modern construction. The ancient arm weighed from twenty to thirty pounds, was made of steel, copper and leather, and could be worn only on a long and powerful stump. The modern arm weighs from one to two and a half pounds, is made of rubber, wood, rawhide, leather, and metal, and can be worn on short, enervated, and nervous stumps to advantage. They have a range of utility infinitely greater than those used by warriors centuries ago.

The need for artificial arms has never been as great as now. The incentive to invent and improve is always responsive to demand. Want begets supply, and competition is the stimulus that carries improvements close to the goal of perfection.

The Demand Greater.—The demand has increased in direct proportion to the utilization of machinery in the industries and to the expansion of methods for rapid transportation. As the mileage of railroads increases, the mutilation of the human body is more frequent. The electric trolley has maimed more than the horse-cars of a decade ago. The mowing machine and the reaper have cut off more limbs than the scythe or cradle, dynamite has mutilated the human body more than the black powder of

former days. These agencies, necessary for quick results, are dreadful implements of death and mutilation.

Simplicity.—In recent years the tendency of the arm manufacturer has been to simplify construction; the earlier devices were complicated, burdensome to carry, expensive to maintain, and unreliable. No one will now tolerate a clumsy, heavy, noisy, complicated, and unwieldly arm; neat adaptation to the stump, lightness and naturalness of appearance, durability and utility, are the only essentials that will satisfy.

What an Artificial Arm Must Do.—The artificial arm must conceal the loss, protect the stump, restore a natural appearance to the dismembered side, provide a medium that will force the stump into healthful activity, and, in the way of utility, it must assist the opposite hand, carry articles of moderate weight, and, if the stump is powerful, the hand must be capable of cutting food on the plate and carrying the morsels to the mouth. The modern arm is capable of all this, and still more. A pen can be placed between the finger and thumb, and, after a little practice, the wearer will learn to write quickly and legibly. Implements capable of specific functions can be held in the hand or in the socket. A ring will help the farmer in guiding the handles of his farming tools; it will assist the blacksmith in wielding the sledge. A pair of pincers is capable of holding the work of a jeweler, a claw hook, a clevis, a hand vise; in fact, a great variety of implements have their distinct uses. While these attachments are capable of a large range of adaptation, there is a limit beyond which art and science cannot go. These operations of the natural hand that depend on the brain for their functions cannot possibly be performed by mechanical devices.

The Natural Hand a Marvel.—The intelligence with which the natural arm is endowed is the result of the system by which mental force is carried from the brain to the distant fingers. The human hand and arm are marvels of mechanism, their combinations of motions are almost limitless, their functions vast, their capabilities beyond comprehension. The motion of the shoulder is circumrotary; those of the elbow, flexion and extension; those of the wrist, rotary, circumrotary, flexion, and extension, and the fingers are capable of a range of accommodation almost limitless. Every joint is connected by powerful sinews, tendons, muscles, nerves, and blood vessels, which perform their work in conveying the commands of the mind to the most distant parts, and in compelling an instantaneous obedience. The hand that is capable of placing the delicate works of a watch is capable of placing the stones of a cathedral. And yet the human arm is but a machine, useless by itself.

The Brain.—The brain is the vis-viva that renders it capable of its wonderful work. If the medium that conveys the wishes of the mind to the arm be destroyed, if the co-ordination be impaired, the natural arm ceases to be any more valuable than an artificial one of the crudest type.

An artificial arm, no matter how ingeniously it may be constructed, pales into insignificance when its functions are compared with those of the healthy arm nature has given us. Nevertheless, it is far more useful than the natural arm that has become palsied.

Self-Repairing.—The natural arm has other endowments, aside from its responsiveness to the will. The power of repairing itself is one of its mysterious attributes. The bearing surfaces of the bones would grind away, the tendons would stretch and become inert if this process were not in constant operation. If a muscle becomes lacerated, or a tendon detached, or a bone broken, the work of reparation soon restores the injured part to its normal relations. Every drop of blood that flows through the arteries carries new material to replace the waste, and every drop of blood that flows through the veins carries away the particles that have become diseased and detached. In old age, when the human repair shop becomes disorganized, the entire physical mechanism breaks down, and the end soon follows.

Sense of Touch.—Another great and important endowment of the natural hand is the sense of touch. This sense is susceptible of cultivation. The contact of the fingers will convey the information that the substance is soft or hard, liquid or solid, dry or wet. The blind man is capable of reading by the tips of his fingers. When we place our hands in our pockets, we know by this sense whether we take hold of a key or a jackknife, a handkerchief or a lead pencil. The moment we touch the object we know what motions the fingers are to make and the strength required to put that object within our grasp.

An artificial hand is absolutely devoid of sensation. When we call to mind the fact that an artificial arm, made with joints, springs, and cords cannot be endowed with mental sympathy or with the power of repairing itself, or with the sensation of touch, we must become reconciled to the fact that it is necessarily of limited capacity.

Stories Misleading.—We are frequently amused by reading newspaper articles on artificial arms, made by forgotten mechanics, "that are fully as good as natural arms." We frequently have to listen to the narration of some magical performances of men who wear artificial arms. We recall an article that appeared in a Canadian newspaper, of a woman who had a pair of arms adjusted to her person, supplementary to her natural ones. She became so dexterous in manipulating them that when in a public conveyance she would hold a book in her artificial hands, and, while apparently reading, would, with her natural hands, pick the pockets of those who sat next to her.

We have also read the story of a politician who lost his arm in the Civil War, and who had an ingenious artificial one applied that enabled him to shuffle a deck of cards, pick up a glass of beer and carry it in his mouth; and, on one occasion, when in a barroom brawl, he liberated a spring, and the arm immediately began

its pugilistic movements, with more vigor and more deadly results than possible for the natural arm. Quite recently a New York paper gave a page to the description of an artificial arm, made by a German prothesist, that incases the undeveloped arm of the Emperor of Germany; the description of the arm and the functions it was capable of performing were extremely absurd and amusing to those acquainted with prothesis, but to laymen unacquainted with the subject, there was a strain of plausibility that must have made some persons believe that at last a mechanic is on the earth who is as skillful as Divinity Himself.

CHAPTER XVIII

IS IT PROFITABLE TO BUY AN ARTIFICIAL ARM?

If I procure an artificial arm, will I make any practical use of it? If I do not, can it in any way contribute to my physical or mental comfort? Is the risk worth taking?

These are the questions that have to be answered. They weigh heavily upon the minds of those who find it necessary to exercise economy in their purchases.

Whether male or female, rich or poor, the feasibility of substituting a member that has been lost must be thoughtfully considered.

Let us first take up the question of ornamentation.

ORNAMENTATION.—That a person will make a better appearance with an artificial arm properly dressed than with an empty sleeve,

is obvious. To conceal any physical defect is a natural aim. There is nothing so distressing, especially to a sensitive person, as the exhibition of any imperfection in his anatomy.

The glass eye is worn for no other purpose than ornament. It fills a sightless socket and conveys the impression that the natural eye is there; it does not restore vision nor fulfill the optical functions, yet thousands of them are worn with a feeling that they are indispensable. They certainly look well, and are to be preferred to the cloth patch frequently seen. The man with a hunched back pays his tailor very dearly for the skillful adjustment of pads in his coat, so as to minimize the visibility of his deformity.

Any deficiency of the body that becomes conspicuous will attract attention and invite comment and sympathy. No person who maintains his self-respect, no matter what his disability may be, cares to be constantly reminded of it, and the commiseration of others, above all things, is the most abhorrent. To be frequently asked: "How did it happen?" "Did you lose your arm in the war?" "Were you in a railroad collision?" or to have such utterances as: "Poor, unfortunate man!" "How he must have

suffered!" "What a terrible loss!" whispered within your hearing, may, for a while, be accepted in good part, but their repetition soon becomes annoying and odious.

An artificial arm will conceal the loss, restore a natural appearance to the person, avoid observation and comment, and after it has been worn a short time will become companionable and necessary to the wearer's mental comfort.

The Russian prince, Galitzin, obtained an artificial arm of us to cover a deformed and undeveloped member, the conspicuousness of which had given him much solicitude. He was elated over the results and pronounced the purchase a most satisfactory one, fully paying him for his long journey from Moscow to New York.

Miss Julia Shay Lindsay, of Polk County, Minn., struggled with this subject for some time, and finally ordered an artificial

hand. The results that followed are clearly set forth in a letter recently addressed to us: "It is over five months since I received the artificial hand which my doctor ordered for me. I am very much pleased with it. No one can tell the artificial hand from the natural one. In this, it is a source of great comfort."

A. T. Basden, of Hamilton, Bermuda, who had both of his arms amputated between the elbows and wrists, wrote recently, as follows: "The artificial arms you sent me fit acceptably. They meet with my expectations. I find them helpful and especially valuable, as they hide my misfortune. Prior to the application of the arms, I suffered considerably with my stumps, but since wearing them the pain has entirely ceased."

Hygiene.—This part of the subject, considering the importance it bears to the general health and welfare of the individual, has not been sufficiently emphasized. With much pleasure we quote

from Dr. Schenck, of Cincinnati, Ohio: "Pain is the cry of a hungry nerve for food.

"When a part of the body becomes inactive, as is the case with the stump of an amputated arm, the inability to receive the necessary activity on account of the abbreviation of its length, permits the stump and muscles to fall into a quiescent condition; in consequence there occurs a stagnation in the venous system, which depends entirely upon muscular activity for the return of the venous blood to the lungs for aëration, from whence it is again pumped by the heart to the different parts of the body, in order to carry nourishment and oxygen to the tissues so that the normal metabolism can occur, and thus produce the physiological tone required for a healthy individual.

"As such, an abbreviated member, unassisted, cannot contribute the necessary energy for its welfare; because of the above-explained pathological condition, it must suffer and lose its normal tone and indirectly, as in diseased organs of the body, affect the general economy in a more or less degree, depending upon the temperament of the individual.

"So that, from the hygienic view, an artificial arm will cause the defective part to functionate, causing activity of the remaining muscles, and thus stimulate its circulation, giving to the part the required nourishment and preventing the accumulation of effete material and dismissing a conspicuous deformity, which, no matter how indifferent the unfortunate assumes to be, has some influence upon his nervous system, all of which, being improved, is conducive to promote a healthy tone to the whole body."

It is not an infrequent occurrence for a person to complain of peculiar, dull aches, or nerve twitchings, or sharp, stinging darts of pain in his stump. Investigation will disclose the fact that these are nervous disturbances, due to muscular inactivity, and, as soon as stumps are forced to do something, the distress will almost invariably disappear.

Dr. Cook, United States Examining Surgeon, puts this phase of the subject in an interesting and unique light:

"When a limb has been amputated, the stump, or remaining portion, takes on queer antics and assumes conditions that are in accordance with well-known physiological and psychological laws.

"For instance, it is no uncommon occurrence for a man who has lost a part of his leg by amputation to have a severe pain in the heel, foot, or toe of the lost member, or for those who have lost parts of their arms to have excruciating pains in the wrists, hands, or fingers of the amputated parts. To those unaccustomed to these nerve complications this may appear absurd, but they are facts well known to neurologists.

"It would seem that the stump, or part remaining after amputation, either resented the indignity that it had been subjected to, or else made its sorrow for its loss manifested by these means.

"The man who allows an amputated arm to hang indolently by his side makes a mistake. The muscles above the stump shrink and waste away for a lack of nourishment, and the nerves become irritable and neuralgic. An undisputed physiological law is that 'action increases strength,' and the reverse is just as true, that inaction produces weakness.

"Place an artificial arm on the idle stump and it at once begins to get a better circulation of the blood, the muscles begin to develop, and the nerves have something to think about besides their terminals."

Dr. L. G. Armstrong, of Boscobel, Wis., in emphasizing the importance to persons who have had legs or arms amputated, to procure artificial ones, presents in a forcible way the penalty that must be paid if a stump is permitted to become indolent:

"Artificial limbs have added much to afflicted humanity in the way of happiness and comfort.

"Physiology teaches plainly that the want of use of any part begets weakness. Atrophy of the muscles is sure to follow, which is the legitimate consequence of the neglect. To prevent this, begin using the stump as soon as it is thoroughly healed, when the adhesions are perfect, save atrophy, and put the muscles to their new use. Neuralgia of the stump is always sure to follow, or it may even antedate the withering away of the muscles for the want of proper use. Get a well-made, perfectly fitting limb, and you have at once removed the cause of nervous disturbances and the mental shock. You have added much to the person's ability to earn a livelihood. My experience is that artificial limbs are soon accepted, and soon used to advantage, and so much so that money would not induce the wearers to do without them. My advice is to get an artificial limb at the first practical moment, after the stump is perfectly healed."

Dr. T. P. Smith, of Tacoma, Wash., says: "During the last fourteen years you have fitted a great number of my patients with artificial limbs, and they have all given entire satisfaction. The proposition that a limb, whether a stump or whole, needs and is benefited by motion, is so self-evident as not to call for discussion; a stump becomes useless without it.

"I am in the habit of using motion in all cases of fracture, as well as in all cases of amputation, to prevent atrophy of the muscles, and stiffening of the joints, and as soon as a stump, after amputation, is healed, I insist on applying an artificial limb. Until the limb comes, I insist on the patient doing the best he can toward exercising and using his stump. After the limb is adjusted he will naturally use it, and that will prevent the stump from becoming flabby and fat.

"In conclusion, I will say that I know of no way to retain the use of a leg or arm, except it be early fitted with an artificial limb, and the sooner it is done the better. In spite of bandaging, and such motion and exercise as patients can give their stumps, they become large and flabby."

Dr. Geo. E. Powell, La Crosse, Wis., writes: "We have had your artificial limbs for twenty years and consider them the best made. We have never applied one that did not give satisfaction. Many arm stumps that were soft and doughy to the feel, became strikingly firm and vigorous with the use of artificial arms."

Dr. Chas. F. Noe, of Amana, Ia., states: "I wish to say that in my experience a well-fitting artificial arm exercises a beneficial influence on the stump, due to the stimulus given to circulation and nutrition, and thus preventing stagnation from disuse."

Dr. J. H. Sieling, of York, Pa., says: "The arm that you sent me recently has done more work than my fondest hopes expected; it has not only had a helping influence on my patient's stump, but adds greatly to his appearance. He is able to execute some very helpful acts with the elegant equipment; he eats, by its help, very artistically indeed. I am only too glad to add a word of commendation whenever opportunity offers."

Carl M. Person, of Webster County, Neb., states: "I will write to you and let you know that my arm is all right. I have worn it every day since I got it, and have never been chafed or experienced any inconvenience. The arm is useful as well as ornamental. I find that the exercise my stump receives from it prevents those dull pains that I suffered from for so long a time, and I value it for this reason far more than the money it cost."

William F. Starner, of Carroll County, Md., writes: "I have been wearing one of your artificial arms for about three years, and am well pleased with it. I can do most any kind of work. The arm exercises my stump, and keeps it in a more pleasant condition."

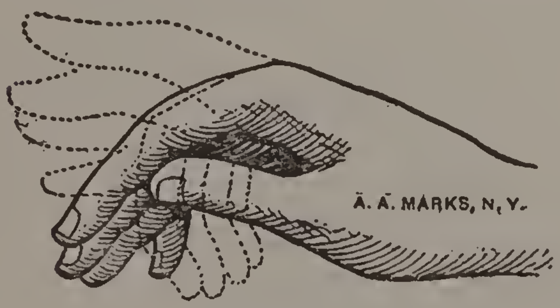
The utility to be derived from an artificial arm depends very largely upon the length of the stump, the strength of the muscles, and the aptitude of the wearer. The stump must be long in order to provide a lever with which to control the hand and forearm in lifting such articles as may be placed in the hand. Although the artificial arm is very light, the power to elevate it must come from the muscles in the arm and shoulder, and when the stump is very short, and the muscles weak, the utility of an artificial arm is lessened. But, notwithstanding these conditions, the artificial arm should be worn on the shortest of stumps. There are persons who have more aptitude than others, and perform feats under adverse conditions that are marvelous; some with short stumps do more than others with long ones. It is safe to say, however, that any person, no matter how short a stump he may have, may, with patience and application, learn to operate an artificial arm, and derive a reasonable compensation from it. Ambition, application, and thoughtful effort will overcome many difficulties. If one person can learn to write quickly and legibly with an artificial hand, why should not another? If one person can handle a farming implement, such as a hoe, rake, ax, or wheelbarrow, or a carpenter can drive his plane, hold a nail or carry tools, there is no reason why others should fail.

CHAPTER XIX

WOODEN HANDS. RUBBER HANDS

Old Methods.—During the first decade of our prothetical career (from 1853 to 1863), we manufactured mechanical hands, they were carved from wood with fingers jointed at the knuckles, controlled by straps operated by the shoulder. By a forward motion of the opposite arm, the strap would apply a pulling force to the artificial hand and force it to open. By relaxing, the strain on the strap would be released and the hand would close. It would seem as though a hand of this character would be useful and valuable, but when the invariableness of the spring tension, the oppressive harness to be worn, and the exertion required to operate the straps were considered, it was doubtful that the results obtained justified the means employed.

New Methods.—In 1863 our attention was attracted to the utilization of rubber, the resilient nature of which appealed to us as being better adapted to the purposes of an artificial hand than harsh, unyielding wood or metal. The rubber hand was thereupon invented. It was cast in a mold made from the model of a natural hand, and it was attached to the end of the artificial forearm by means of a spindle. The fingers were flexible and would yield under pressure, having sufficient elasticity and adhesion to hold light articles. It presented a natural appearance and was pleasant to the touch. It was far more durable than the wooden hand. It might fall or strike a hard object and would not break. It could be slipped from the socket and a hook, knife, fork, brush, ring or other implement put in its place. For a number of years this hand found many purchasers, and was



Cut O 1.

Cut O 2.

greatly admired. Improvements were suggested from time to time.

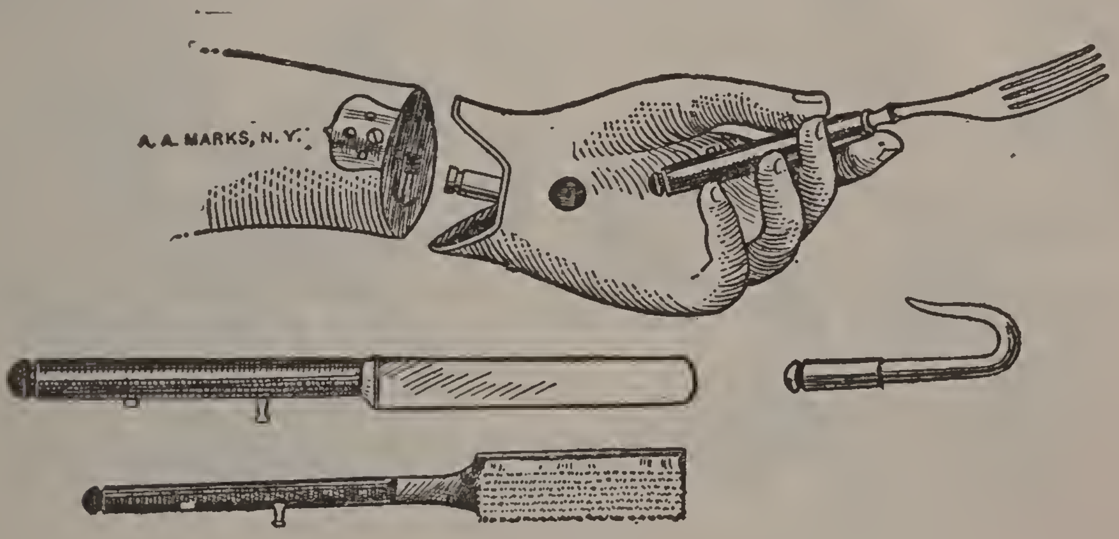
Ductile Fingers.—A fortunate thought was that of changing the fingers from flexibility to ductility. Flexible fingers would move under pressure, but as soon as that pressure was released

they would return to the positions in which they were cast. The ductile fingers admit of change of position. The wearer can, by the opposite hand, or by pressing the fingers against some resistant object, change their positions from full extension to clinched. The hand with fingers partly closed is sufficiently firm to carry a valise or package. Cut O 1 represents the rubber hand partly closed. The dotted lines indicate the positions of extension and flexion in which the fingers can be bent.

Palm Locks.—A lock embedded in the palm, shown in Cut O 2, receives and holds implements with firmness. A hand brush, a knife and fork (as shown in Cut O 3) can be thus placed and have the appearance of being grasped by the fingers. When it is required to carry articles of considerable weight for a great length of time a steel hook is slipped in the palm socket, and, concealed by the hand, it is held with sufficient strength to carry an article of one hundred pounds in weight. A knife or fork can be put in the same socket; the latter will hold a piece of meat while it is being cut with the opposite hand, and will convey food to the mouth. A brush placed in the palm lock can be used in washing the opposite hand. When it is desired to remove an implement a little pressure is applied to the button and the implement is released, and can easily be taken from the socket.

Wrist Connections.—Rubber hands are attached to forearms by various methods.

Cut O 3 represents the spindle method. A steel spindle is attached to the base of the hand, and made to fit a locking plate secured to the base of the forearm socket. The hand when so placed will rotate at the wrist if the wearer wishes. When it is



Cut O 3.

desired to remove the hand a little pressure applied to a button will release the hold, it can then be taken from its place. When it is desired to prevent the hand from rotating a set screw is turned inwardly, and the hand is clamped firmly in one position. A variety of implements are illustrated in the cuts O 4 to O 7, each can be placed in the forearm substituting the hand.

Clamps.—Cut O 8 represents a new device for a wrist-joint connection, it is intended for a person who works at the bench. The

end of the forearm is made of aluminum, and provided with a sliding jaw operating as a vise. A cold chisel can be held firmly at any convenient angle, shown in Cut O 9; a saw-file can be used to advantage, as shown in Cut O 10. A jeweler's hammer, or in fact any implement with a handle not greater than ⅝ of an inch in diameter can thus be held in a thoroughly practical way.

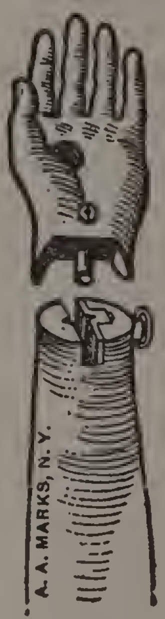
FLEXION.—The mortise and tenon wrist connection is preferable


Cut O 4.

Cut O 5.

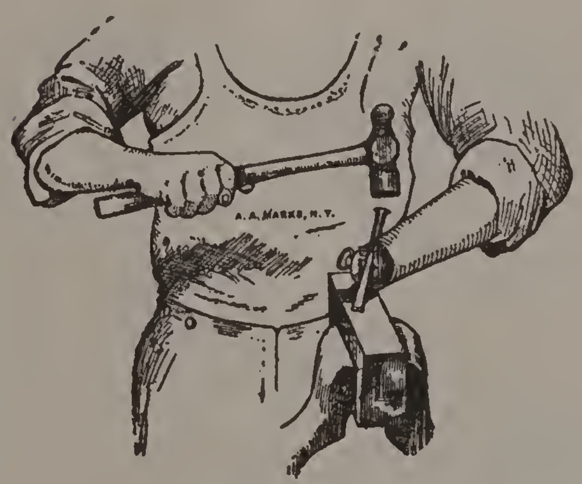
Cut O 6.

Cut O 7.

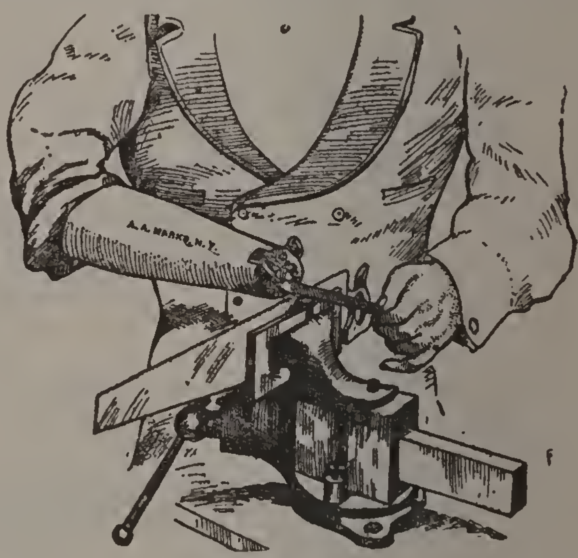


Cut O 8.

to any wrist mechanism that admits of flexion and extension. Cut O 11 represents this method. The mechanism consists of a series of interlaying strips, held together by a bolt, which forms the axis of motion. Rotation of the arm is obtained, when de-



Cut O 9.



Cut O 10.

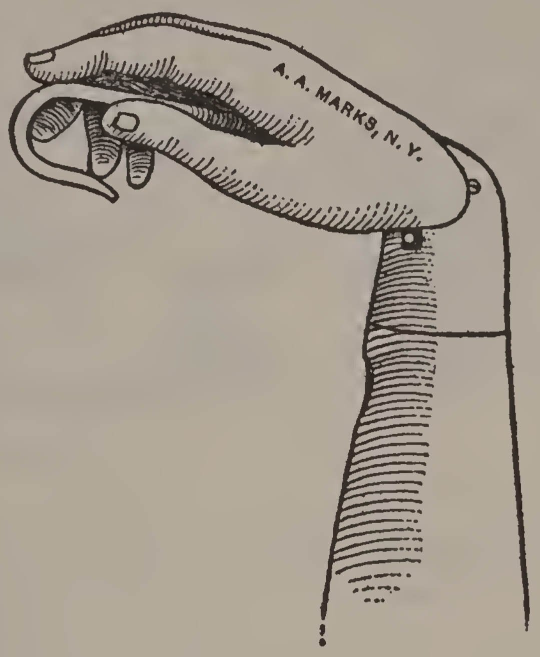
sired, by means of a bolt connection introduced immediately above the wrist joint.

Cut O 12 represents the mortise and tenon connection, the hand flexed holding hook. Cut O 13 shows the hand extended, with fork held by the palm lock, the knife and other implements are held in the same way.

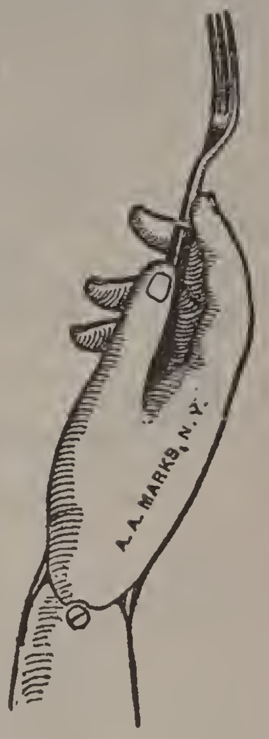
For laborers who wish to obtain the greatest variety of prac-

tical uses from artificial arms, the spindle connection at the wrist (Cut O 3) is preferable. This device admits of greater strength and enables the wearer to press the artificial hand against any object desired to be held in place. The mortise and tenon wrist

Cut O 11.



Cut O 12.



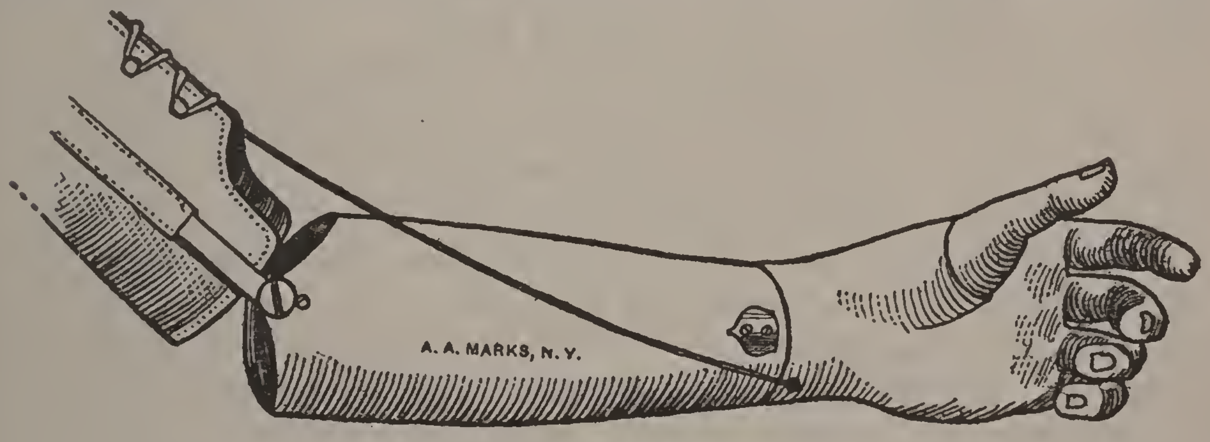
Cut O 13.

connection, illustrated in Cut O 11, is chosen by persons seeking ornament more than utility.

When lightness is a paramount consideration it is advisable to have the hand permanently attached at the wrist.

This method obviates any metal connection, and thereby lessens the weight.

Spring Thumb.—We have a mechanical device by which the thumb can be made to move at its base, away from or toward the fingers. Cuts O 14 and O 15 represent the hand with the thumb ab-

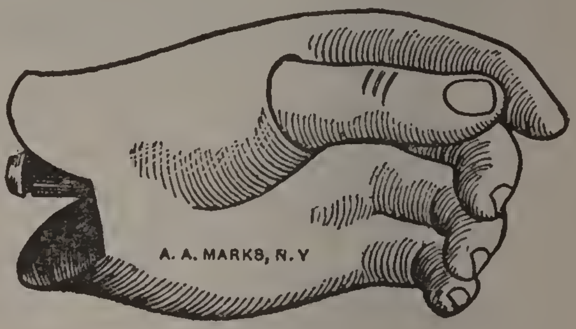


Cut O 14.

ducted; this is effected by tension applied to a cord passing from the under side of the base of the hand upwardly to the elbow. Cut O 16 represents the hand with thumb pressed against the finger. As soon as the tension of the abductor cord is released, the thumb will be forced by a strong spring to press against the index and middle fingers. When the abductor cord is connected with the

artificial arm above the elbow, the thumb will press against the forefinger when the elbow is flexed, and will draw away from it when the elbow is extended, as shown in Cut O 16. The abductor cord may be carried up the arm, over the back, around the opposite shoulder, by which it will be controlled. When thus

Cut O 15.



Cut O 16.

connected it is independent of elbow motion and is operated by a movement of the shoulder or contraction of the chest.

As considerable mechanism is required in the spring thumb, the construction is more or less complicated, and we do not advise its selection except in special cases. In double amputations, when all dependence must be placed upon artificial means, spring thumbs are advantageous; but in single amputations they prove to be quite useless; the remaining natural hand becomes so adept that it performs about all the work that prior to the amputation was performed by both hands.

Gloves Always to Be Worn.—Artificial hands and parts of hands must be gloved at all times. This is necessary in order to conceal the fact that they are not real. Artificial hands, whether made of wood, rubber, or other material, may be modeled to the shape of nature, and have all the graceful lines, creases, and folds that are found in the natural hand..

They may be painted and tinted with artistic nicety, yet it is not possible to impart to them the characteristics which distinguish nature from art. The natural hand has a different tint in the forenoon than it has in the afternoon; when the fingers are extended there are more creases in the skin than when they are flexed; when the hand is at labor it is broader and the muscles and blood vessels show with more prominence than when at repose. An artificial hand, no matter of what material it may be constructed, cannot possess this metamorphic power. It, therefore, must be concealed by a glove, otherwise it will be conspicuous.

Choice of Material for Sockets.—Sockets for artificial arms may be made of wood, leather, or aluminum, to suit the wishes of the purchaser. Makers of experience are united on this point, and advocate the use of tough, light wood. Wood is capable of being worked into convenient shapes, which it will retain indefinitely. It is lighter than any other material that can be used.

and when strengthened with rawhide is sufficiently strong for most purposes. It is also a non-conductor of heat, and when varnished does not absorb perspiration. The objection to leather is its flexibleness. While this may appear to be desirable, it is actually the cause of trouble. A socket that is flexible cannot be comfortable to wear, as it does not place the pressure at points of toleration; instead, it distributes it uniformly over the entire surface, causing pressure to come as much on sensitive parts as elsewhere. Leather absorbs perspiration, becomes foul and offensive, and unless extraordinary methods are used to keep it clean it will become hard and dead, it will crack and fall to pieces.

Leather sockets are sometimes unavoidable; they will be spoken of in due course.

Metal sockets are objectionable on account of their weight, liability to corrode from perspiration, and their disposition to hold heat. When arms are to be made for persons who work in water, such as dyers, laundrymen, fishermen, oystermen, etc., it will be necessary to use metal, such as aluminum, which receives no injury from exposure to moisture free from salt.

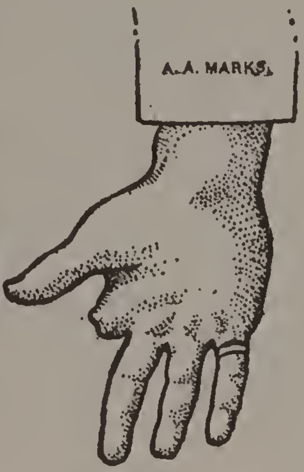
A rubber hand permanently attached to an aluminum socket will provide a useful, resistant, and durable arm, and when frequently cleaned and coated on the inside with sweat-proof enamel or paint, will last a great many years.

CHAPTER XX

PARTIAL HAND AMPUTATIONS

The loss of a finger may be lamentable, but it cannot be considered a serious impairment. The remaining fingers as a rule are competent to perform all the labors that are usually demanded of the complete hand. Yet there are times when the substitution

Cut P 1.



Cut P 2.

Cut P 3.

Cut P 4.

of a lost finger is essential, either for cosmetic effect or to equip the hand for some special purpose; for example, playing the piano, or other musical instrument.

The Loss of One Finger.—Cuts P 1 to P 6 represent hands from which one finger has been removed. An artificial finger

Cut P 5.

Cut P 6.

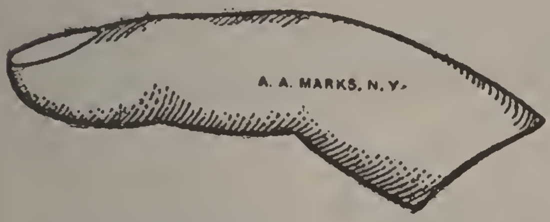
Cut P 7.

Cut P 8.

similar in appearance to that illustrated in Cut P 9 meets the needs of each case. The loss of the thumb, far more than of a finger, impairs the usefulness of the hand. It is, therefore, more important to substitute that loss. Cuts P 7 and P 8 represent

hands from which the thumb has been removed. An artificial thumb similar to that shown in Cut P 10 is suitable for such cases.

MATERIALS.—Artificial fingers and thumbs are made of rubber,

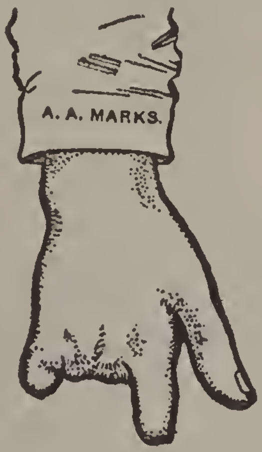


Cut P 9.

Cut P 10.

or silver. Rubber is desirable, if flexibility is an object; silver has the greater durability, is neater, lighter, and

Cut P 11.



Cut P 12.

Cut P 13.

Cut P 14.

more practical. The price is the same for each. When ordering send a plaster cast of both the mutilated and opposite

Cut F 15.

Cut P 16.

Cut P 17.

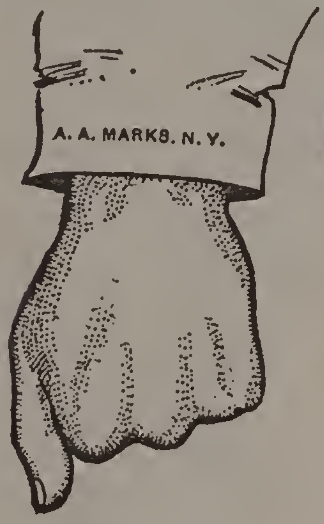
Cut P 18.

hand, one is required for fitting, and the other as a guide in shaping the outside to correspond with its mate on the opposite hand. If the stump, either finger or thumb, is very short, it will be necessary to hold the substitute in place by straps passing around

the base of the hand, or by a glove. If the stump is long, the substitute will remain in place without additional support.

It is important that the artificial part should be covered at all times by a glove, as it is not possible to give it the characteristics of nature closely enough to defy detection.

The Loss of Two or More Fingers.—Cuts P 11 to P 22 represent hands from which two or more fingers have been removed.



Cut P 19.

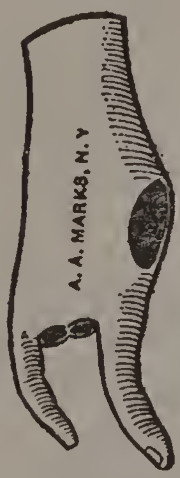
Cut P 20.

Cut P 21.

Cut P 22.

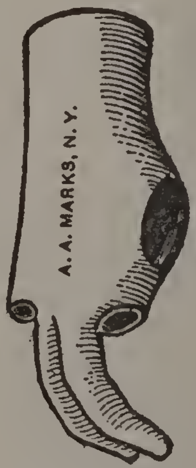
An artificial part for any of these cases consists of rubber fingers attached to a socket that incases the remaining part of the natural hand. This is essential in order to hold the fingers together and provide means for securing them to the stump.

Cut P 23 represents an artificial hand devised to supply the amputation of index and small fingers. Cut P 24 represents



Cut P 23.

Cut P 24.



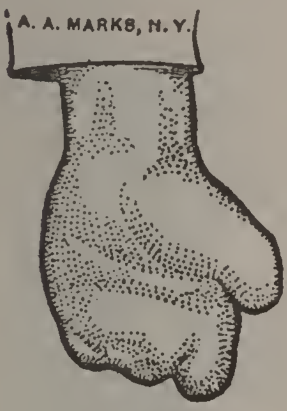
Cut P 25.

Cut P 26.

an artificial hand suitable for use when the index, middle, and small fingers are amputated. Cut P 25 shows an artificial part to substitute the loss of middle and ring fingers. Cut P 26 represents an artificial hand, suitable for a palm amputation, in which the natural thumb remains. The fingers in all the above hands are made ductile, rigid, or flexible, according to the choice of the wearer. For those who do little work and wish to combine ornament with utility, the ductile

fingers should be chosen. For a laboring person, who wishes to lift heavy weights and do hard work, the rigid fingers are better. And for those who wear artificial fingers and parts of hands for ornamental purposes only, the flexible fingers give the greatest satisfaction.

Individual Fingers.—Where the amputation of one or more fingers has been made at the first or second joint, it will not be



Cut P 27.

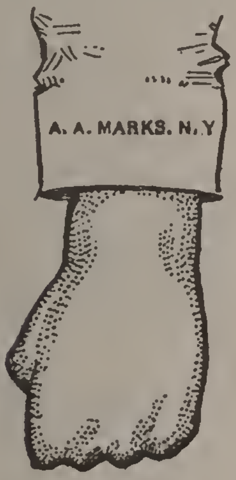
Cut P 28.

Cut P 29.

Cut P 30.

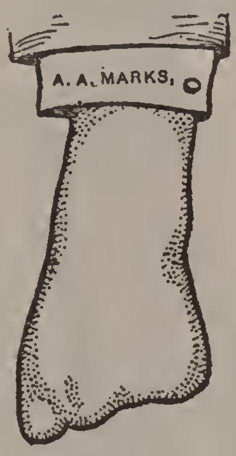
necessary to have the artificial fingers connected at their base; separate fingers, as represented in Cut P 9, can be used.

Amputations that have been made in the palms of hands are capable of prothetic treatment, giving natural appearances to the mutilated members as closely as conditions will admit. If the remaining part of the hand provides a stump that will control the artificial part, a considerable amount of utility can be looked

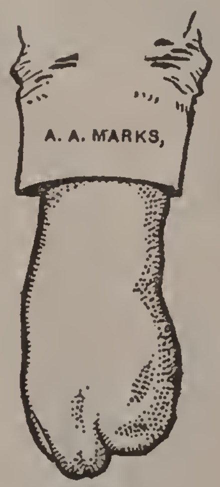


Cut P 31.

Cut P 32.



Cut P 33.



Cut P 34.

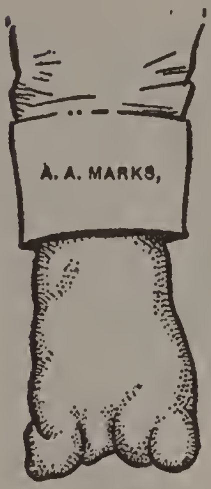
for; but if the stump is of such a character as to offer little or no leverage by which the artificial parts can be controlled, scarcely anything beyond ornament can be assured.

Construction.—The hand below the fingers is made of rubber, combined with canvas and leather, providing a socket for the remaining part of the amputated member; this is laced on line with the palm. If the remaining thumb is greatly abducted, as shown in Cuts P 19 and P 20, caused by the weakening of the flexor muscles, it will be difficult to apply an artificial part that

will possess more than an approximate approach to nature in appearance. It will, nevertheless, materially improve the hand and add to its utility.

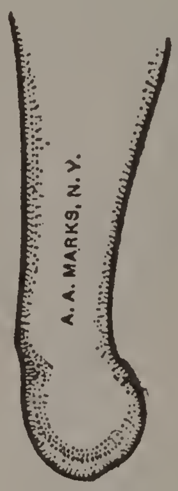
When amputations remove the thumb, as well as the fingers, as shown in Cuts P 27 to P 37, the artificial hand required will resemble that shown in Cut P 38. This hand is similar in construction to that previously described.

It must be noted that on account of the stump occupying the



Cut P 35.

Cut P 36.



Cut P 37.

Cut P 38.

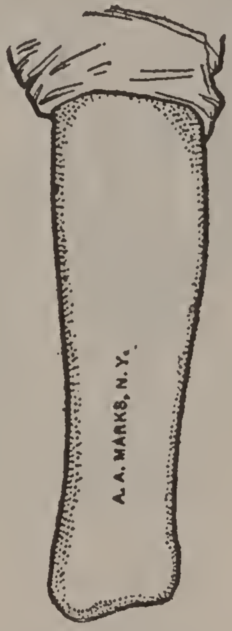
interior of the artificial palm, there can be no mechanism in the hand. When it is desired to have an appliance connected with the artificial part that will hold implements of utility, rings passing over the fingers, or plates riveted to the palms, must be used. These are only furnished when they are especially requested at the time the order is placed.

CHAPTER XXI

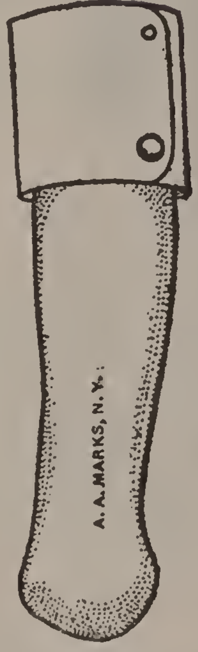
WRIST-JOINT AMPUTATIONS

When a hand is amputated at the wrist articulation, the ulnar

Cut Q 1.

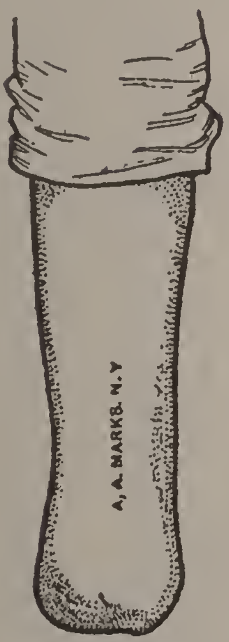


Cut Q 2.

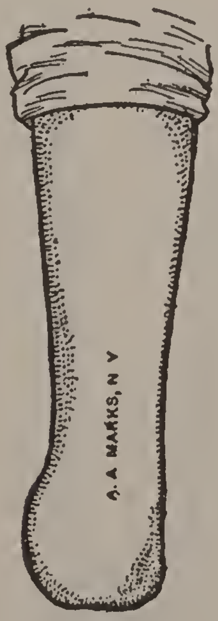


Cut Q 3.

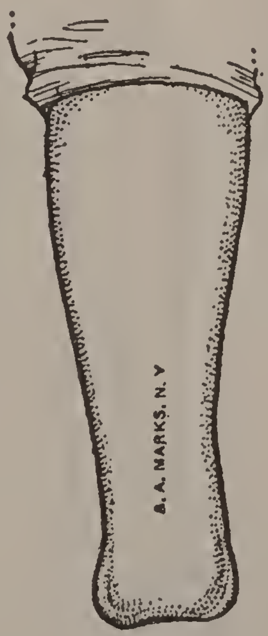
and radial (or styloid) processes are sometimes trimmed off, and



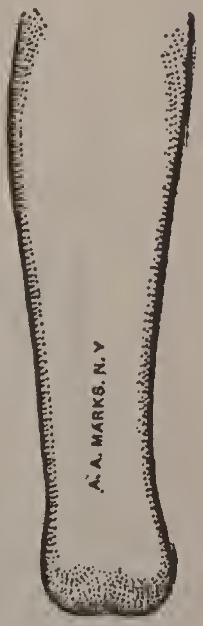
Cut Q 4.



Cut Q 5.



Cut Q 6.

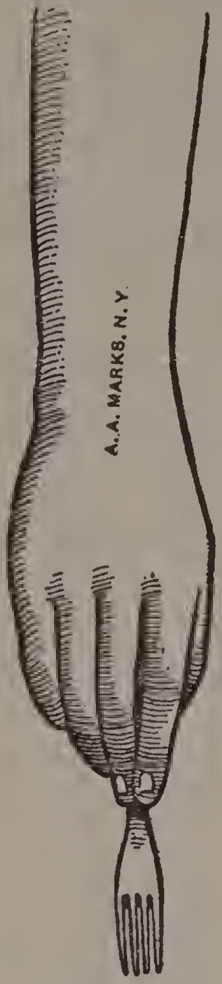


Cut Q 7.

sometimes left as they are, as these prominences form means by which the artificial part can be held firmly to the stump.

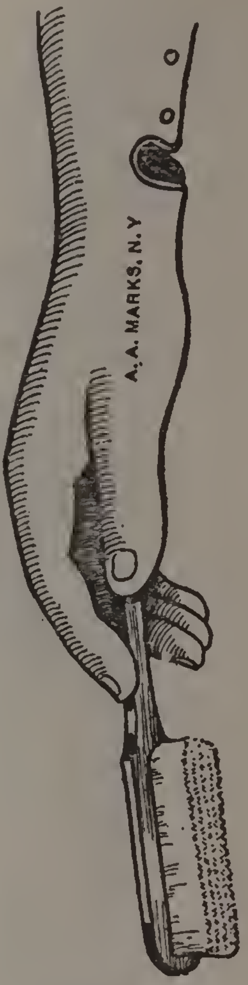
Flat Ends.—Cuts Q 1 to Q 7 represent amputations in the wrist, in which the styloid prominences of the ulna and radius

Cut Q 8.



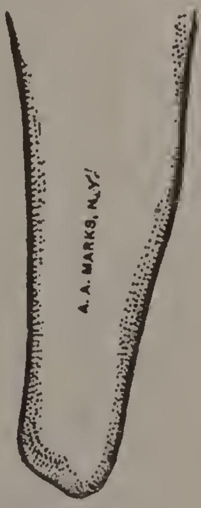
Cut Q 9.

Cut Q 10.

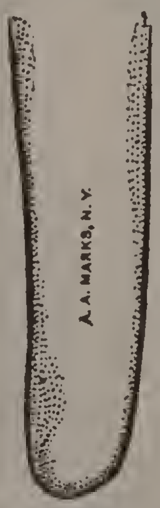


Cut Q 11.

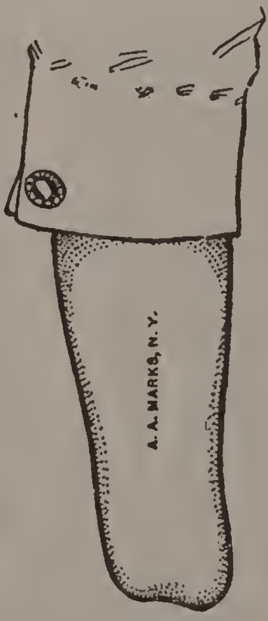
are present. These stumps require artificial arms constructed on the plan shown in Cut Q 8. The hand is of rubber, with ductile fingers, a locking arrangement is imbedded in the palm, as



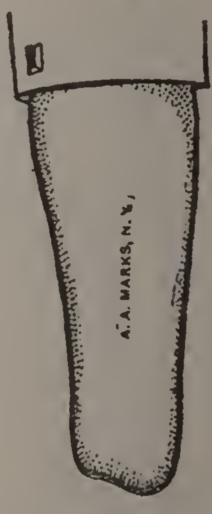
Cut Q 12.



Cut Q 13.



Cut Q 14.

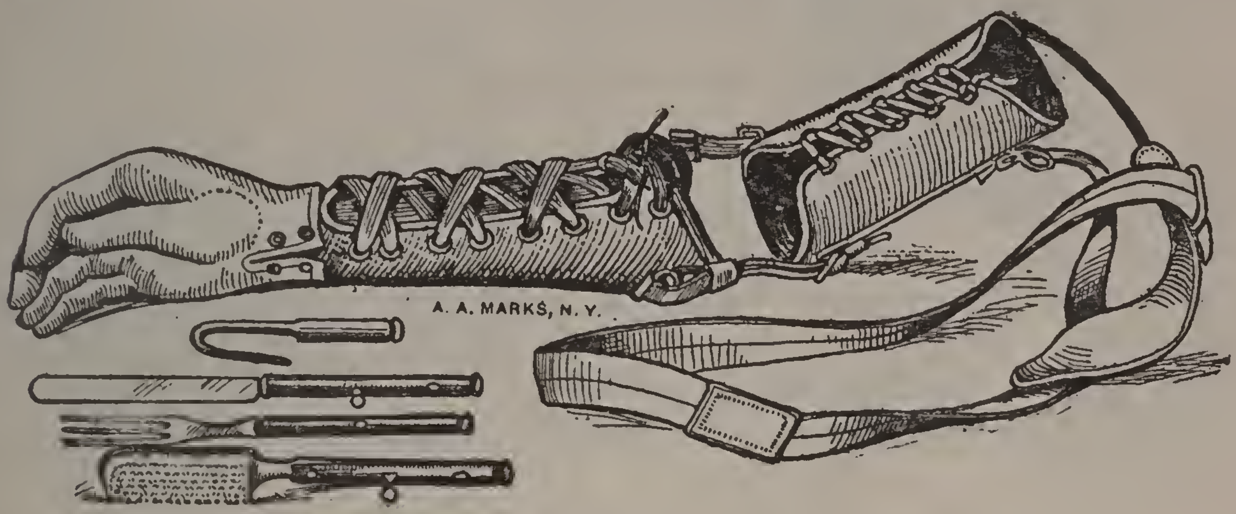


Cut Q 15.

described. The hand is permanently secured to a leather socket, which is formed on a cast of the stump. The arm thus constructed is then placed on the stump and laced down the frontal line. Implements for the table, working, and for washing, etc.,

can be placed in the palm, where they will be held firmly. Cuts Q 9, Q 10, and Q 11 show the various implements in place.

Tapering Ends.—When the styloid prominences have been removed and the stump becomes a tapering one, as shown in Cuts Q 12 to Q 15, an artificial arm constructed on the plan of that



Cut Q 16.

represented in Cut Q 16 must be used. This arm is practically the same as that shown in Cut Q 8, with the exception that it is supplied with attachments that go above the elbow and connect with suspenders resting on the shoulders and passing around the body. These are essential to keep the arm from slipping off the tapering stump. Useful implements can be held in the hand, as shown in Cuts Q 9, Q 10, Q 11.

CHAPTER XXII

FOREARM AMPUTATIONS

When an amputation has been performed at any point between the elbow and wrist, the stump that remains is called a forearm, or radial stump. Cuts R 1 to R 6 represent forearm stumps of a variety of lengths and conditions. The most suitable artificial arm for an amputation of any of the above is illustrated in Cut R 7. The socket is of wood, leather, or metal, as may be selected, shaped interiorly to receive the stump in the most accommodating

Cut R 1.

Cut R 2.

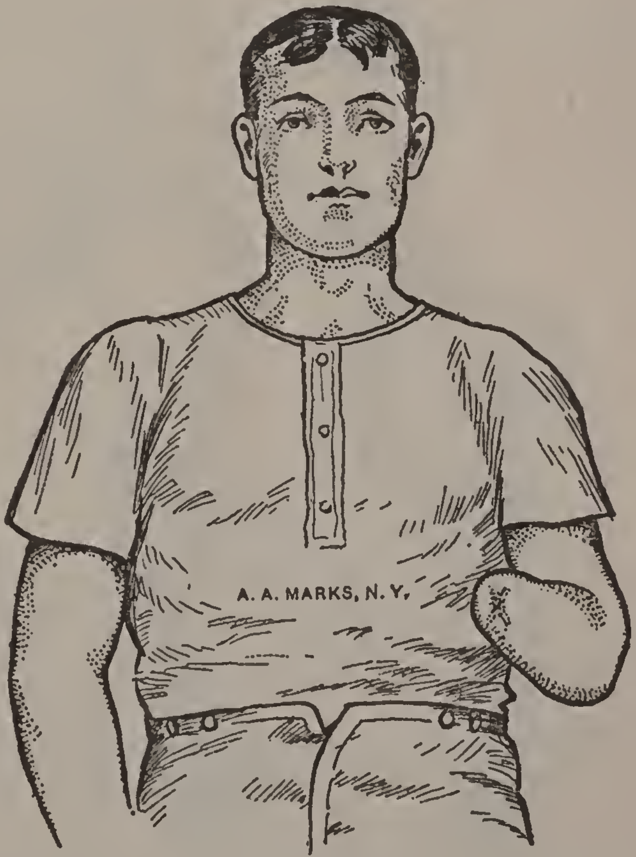
way. The outside is given the contours of the natural arm as closely as conditions will admit, it is then covered with rawhide and enameled a natural tint.

Leather Elbow Joints.—The arm being intended for a long radial stump, the connection with the upper arm piece (incasing the muscle part) is of flexible leather, so as to permit a great range of motion; being adjustable, it can be tightened or loosened, as required; it is absolutely noiseless and very strong; being flexible, it admits of rotation of the forearm. The hand is of

Cut R 3.

Cut R 4.

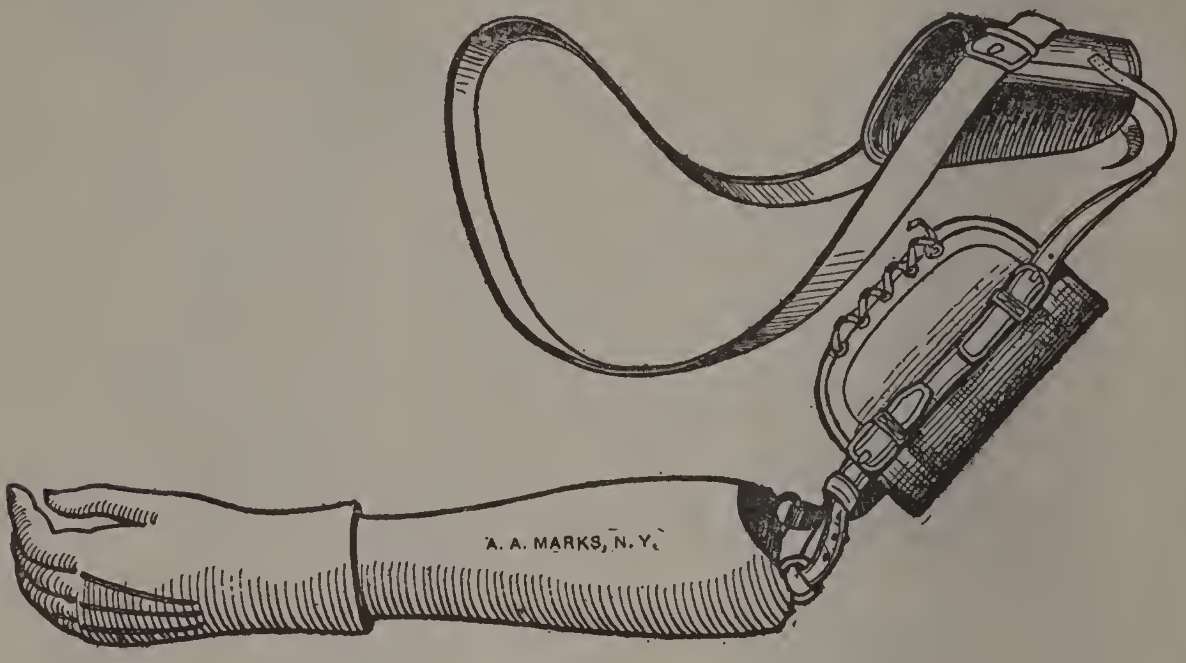
Cut R 5.



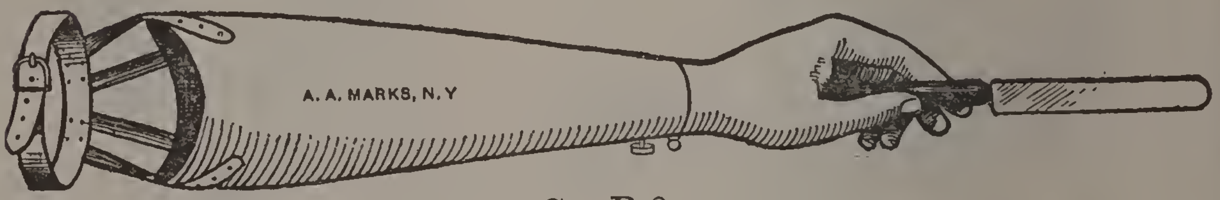
Cut R 6.

rubber, with ductile fingers, as heretofore described. The connection at the wrist is by the spindle or the mortise and tenon method, or the hand can be permanently attached.

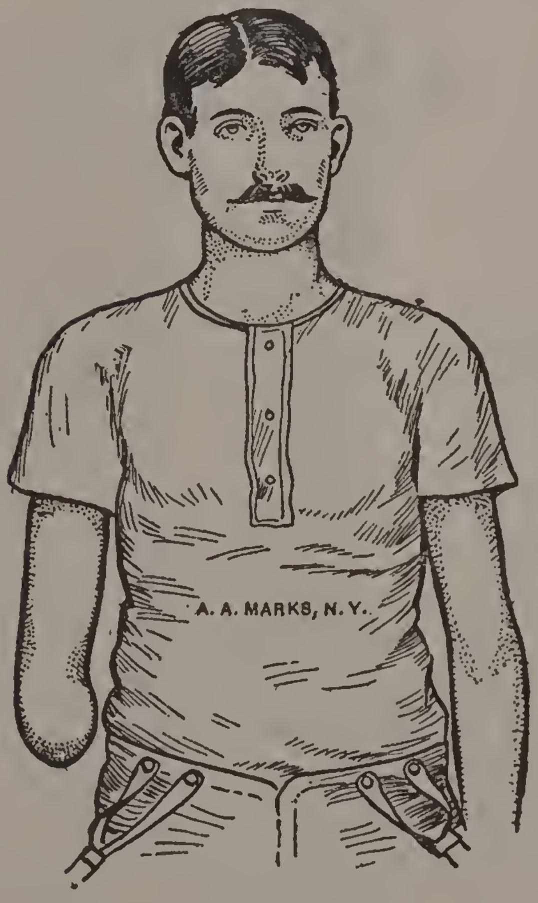
The part incasing the arm above the elbow is made of leather, with suitable straps for regulating pressure. Shoulder straps and



Cut R 7.



Cut R 8.



Cut R 9.

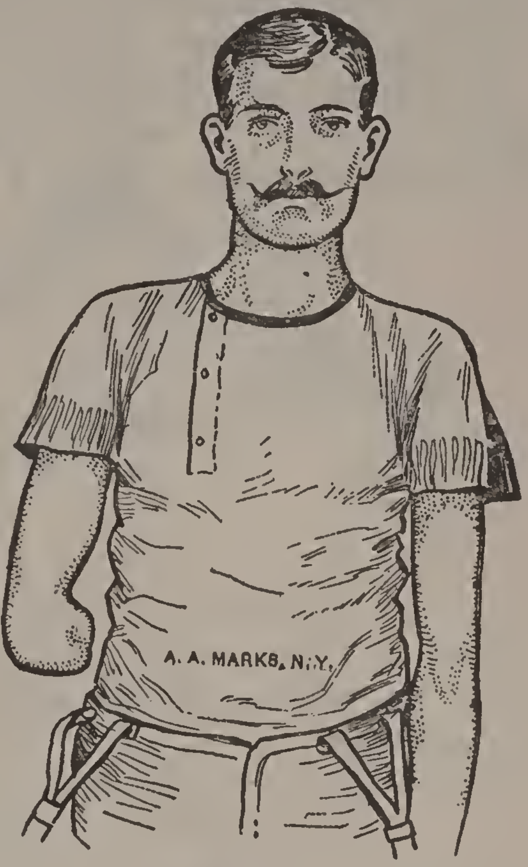
Cut R 10.

suspenders are attached to the upper part of this section.

Arms of this construction are thoroughly available for stumps below the elbow five or more inches in length.

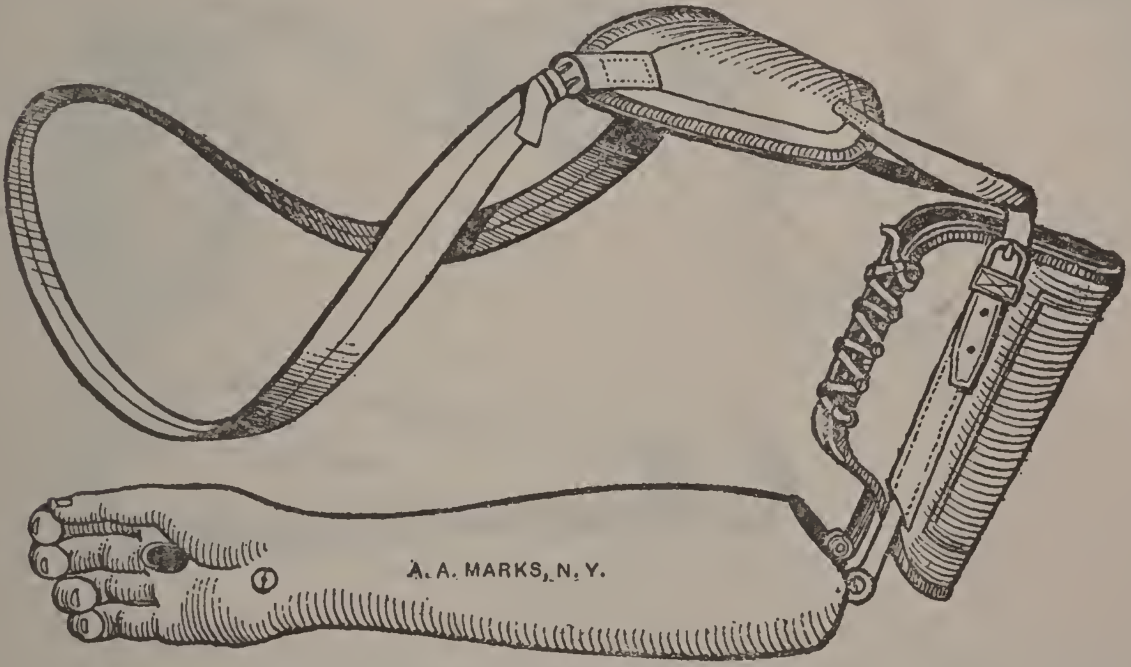
It is sometimes desirable in long radial stumps to secure the arms by a narrow strap above the elbow instead of by the long

Cut R 11.



Cut R 12.

leather muscle part. Cut R 8 represents an arm of this character. This method of attachment is adequate when the artificial arm is



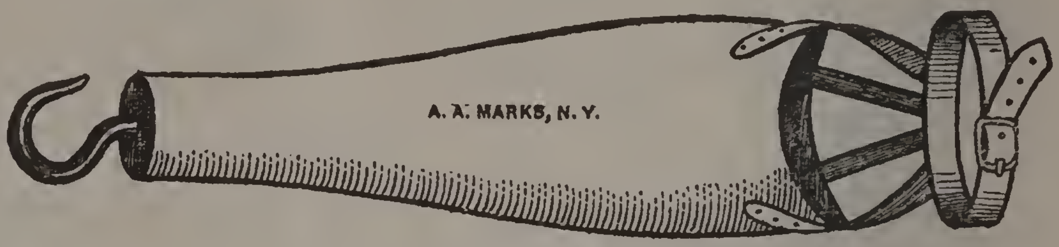
Cut R 13.

not used for carrying heavy articles or in performing laborious work.

Steel Elbow Joints.—Radial stumps that are shorter than five inches, as shown in Cuts R 9 to R 12, require a firmer method of securing the stump socket to the upper-arm part than the leather

joint above described. Cut R 13 represents an artificial arm constructed practically the same as R 7, differing in the elbow joint. Steel hinge joints are used instead of leather. While there is less freedom in the elbow movement, the steel joints place the arm under firmer control of the stump.

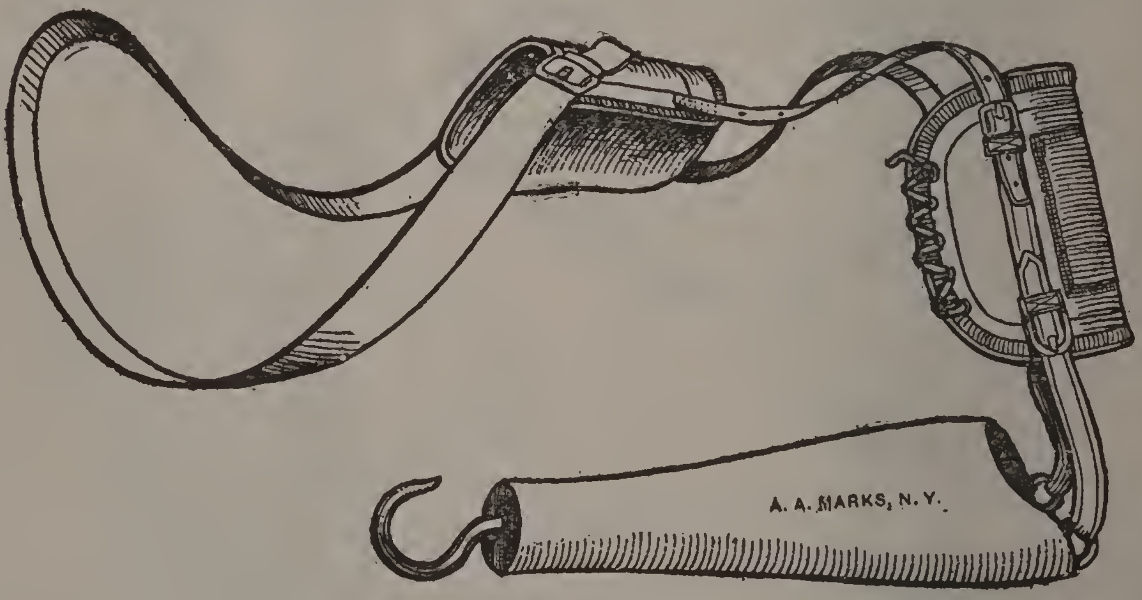
SHORT STUMPS.—This arm is, as a rule, made with hand permanently attached, in order to minimize weight. When an amputation below the elbow leaves a stump so short that when flexed the



Cut R 14.

projection beyond the line of the upper arm is insufficient to control the movements of the elbow, it must be treated the same as an amputation in the elbow joint, as described in the following chapter.

ARMS WITHOUT HANDS.—Peg arms for radial stumps are of several kinds, made of wood, leather, or aluminum; they are practically artificial arms without hands. Cut R 14 represents a peg arm without long muscle part or suspenders. Cut R 15 shows a peg arm with long muscle part and suspenders; both the

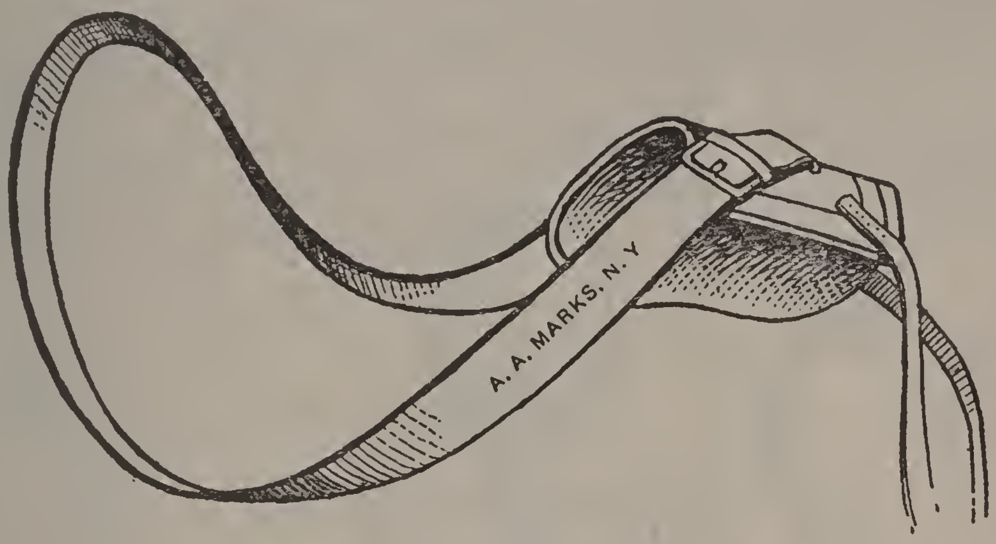


Cut R 15.

above peg arms are constructed in the same manner as those heretofore described, the absence of the hand is the only difference. Farming, shop, and other implements can be devised for specific purposes and held in the ends of the forearms.

SUSPENDERS.—Cut R 16 represents a suspender suitable for an arm for a radial amputation. Suspenders must be renewed occasionally, according to the demands that are made upon them by

the wearer. If the arm is used by a laboring person and he perspires very freely, a new suspender will be required more frequently than if less destructive conditions prevail. The suspender can be procured independent of other parts. It consists of a



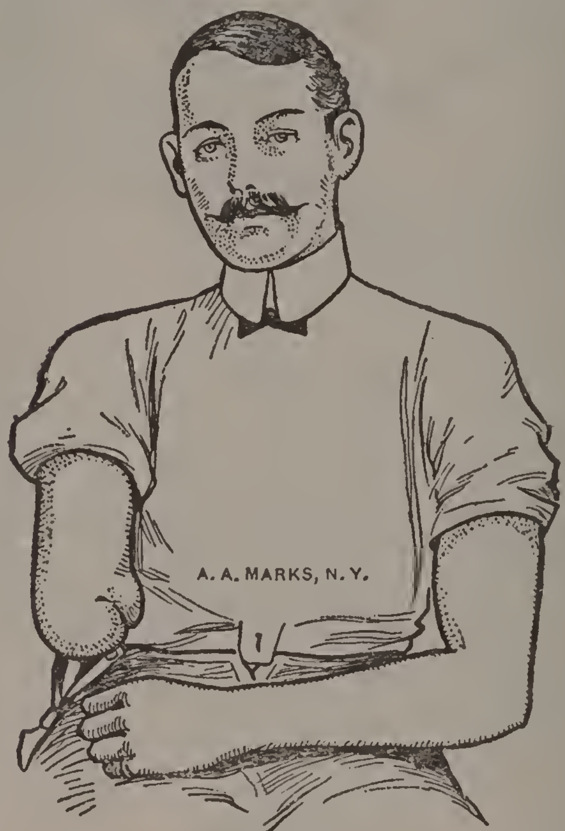
Cut R 16.

plate of leather shaped to rest on top of the shoulder and fit close to the neck. A webbing strap passes around the body under the opposite arm and buckles to the suspender in front.

CHAPTER XXIII

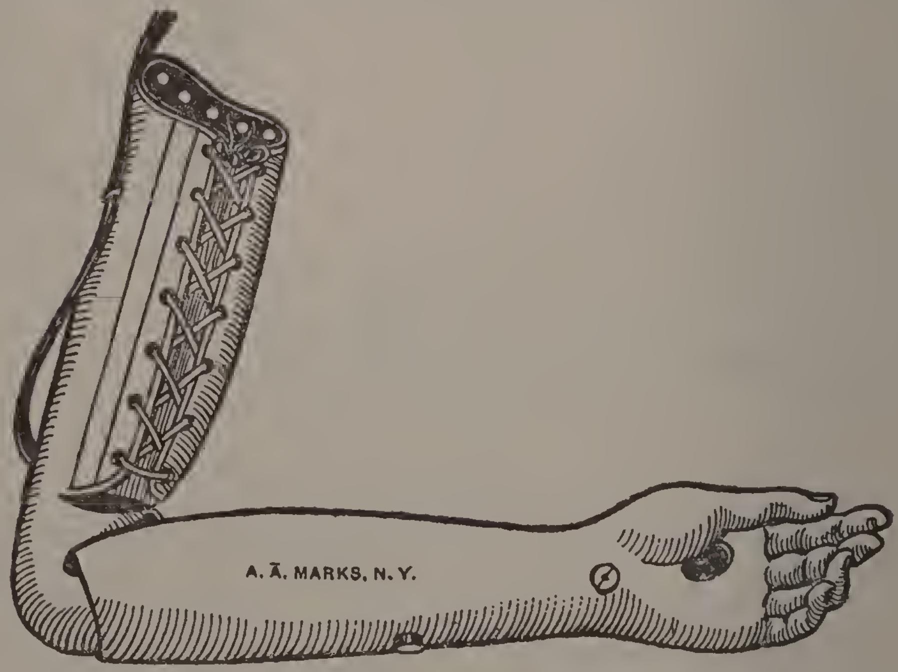
ELBOW-JOINT AMPUTATIONS

Amputations in or immediately below the elbow joints, leaving



Cut S 1.

stumps so short they cannot be availed of in controlling the arti-



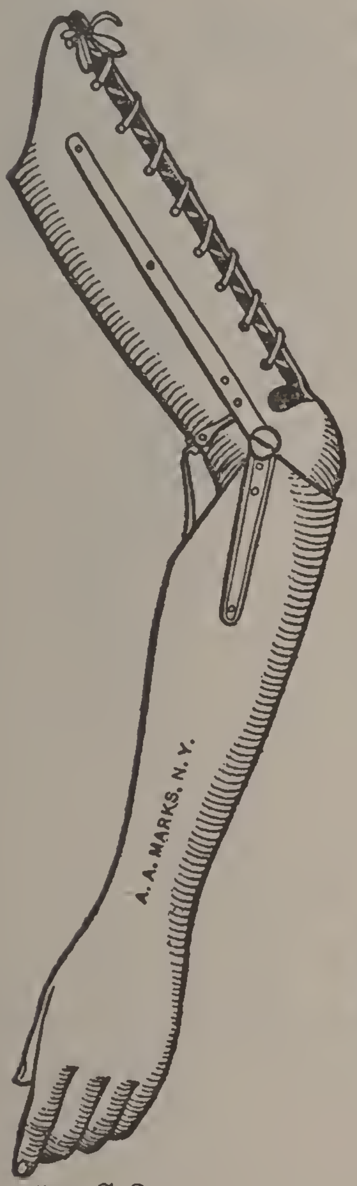
Cut S 2.

ficial elbow joint, require artificial arms of special construction.

The presence of the condyles, or bony prominences, affords an opportunity for fitting that will secure firmness without employing shoulder straps, or, if not dispensing with them entirely, simplifying them very materially.

Short Radial Stumps.—Cut S 1 represents an amputation a little below the elbow joint, but very close to it, leaving a stump so short that it cannot be utilized. A suitable arm is illustrated in Cuts S 2 and S 3. This arm is especially designed for an amputation through the elbow joint.

Construction.—The forearm is made of wood, shaped to the contours and dimensions of the natural arm, excavated to receive



Cut S 3.

Cut S 4.

Cut S 5.

the stump properly and to reduce weight, covered with rawhide to obtain strength, and finished in enamel. The hand is of rubber, attached to the forearm by either of the methods heretofore described. The palm is provided with a locking arrangement that will hold implements of utility. The elbow joint is of the ginglymoid pattern and is operated by a flexion strap under control of the opposite shoulder. The elbow joint is provided with a locking arrangement that will hold the arm in flexed position when desired. The socket receives the stump, which, on account

of its enlarged extremity, is inserted from the front and held by lacing. Cut S 3 represents an artificial arm practically the same as an S 2, except that the stump is placed in the socket from the rear instead of the front. Cut S 4 represents the same with the hand slipped off and a hook inserted in the end of the forearm. This can only be done when the arm is so constructed that the hand is connected with the forearm by the spindle attachment. In style S 3 the upper section is made entirely of leather, formed on a cast of the stump, modified as the conditions require.

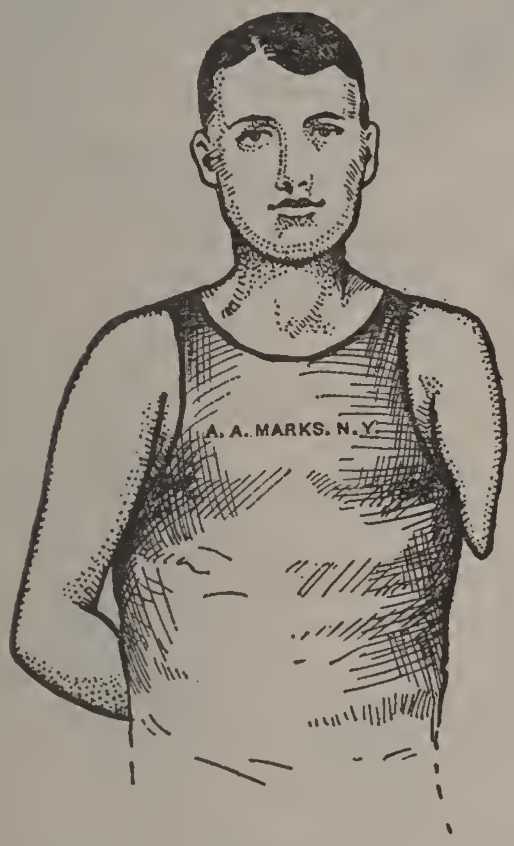
Arms without Hands.—Peg arms for elbow-joint amputations are found useful for laboring purposes. Cut S 5 gives the simplest form. It is without articulation at the elbow. It receives the stump from the front and is held in place by lacing; it may be made of wood, leather, or aluminum. When made of wood it is strengthened with rawhide and enameled. The end of the socket is provided with a wrist plate for holding useful implements. When the conditions of the stump require, a suspender is provided which rests on top of the shoulder and held in place by a strap passing around the body under the opposite arm. The arm, as shown in the cut, is usually made slightly bent at the elbow and approximately the length of the opposite arm. When elbow-joint motion is required it becomes the same as S 4, without a hand.

Suspenders are the same as those used on arms for above-elbow stumps.

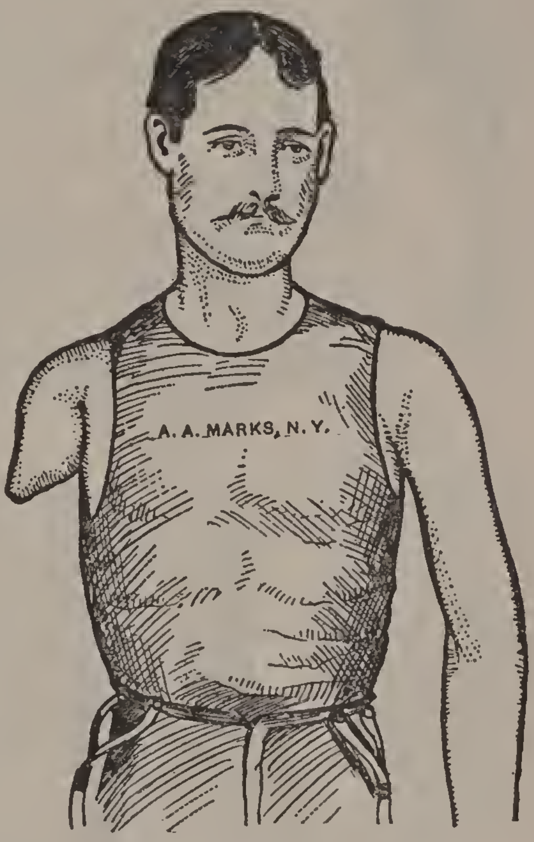
CHAPTER XXIV

ABOVE-ELBOW AMPUTATIONS

An amputation at any point between the shoulder and elbow produces what is known by surgeons as a humeral stump. Cuts T 1 and T 2 are fair examples.

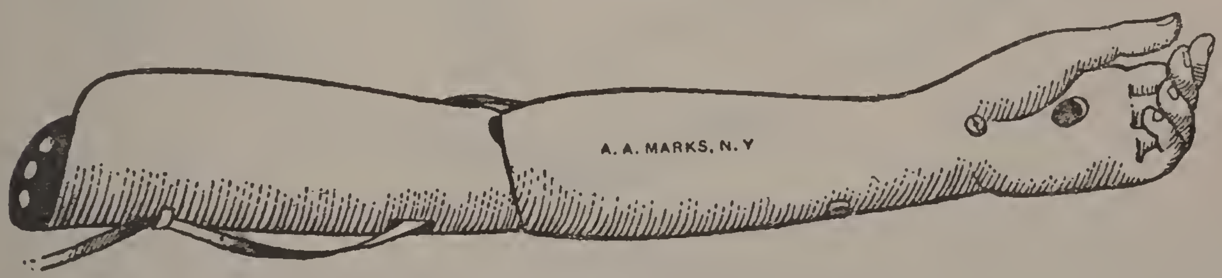


Cut T 1.



Cut T 2.

Artificial arms suitable for humeral stumps are usually provided with artificial elbow articulations, which are flexed and extended by a swing of the body or by the contraction of the shoulders.

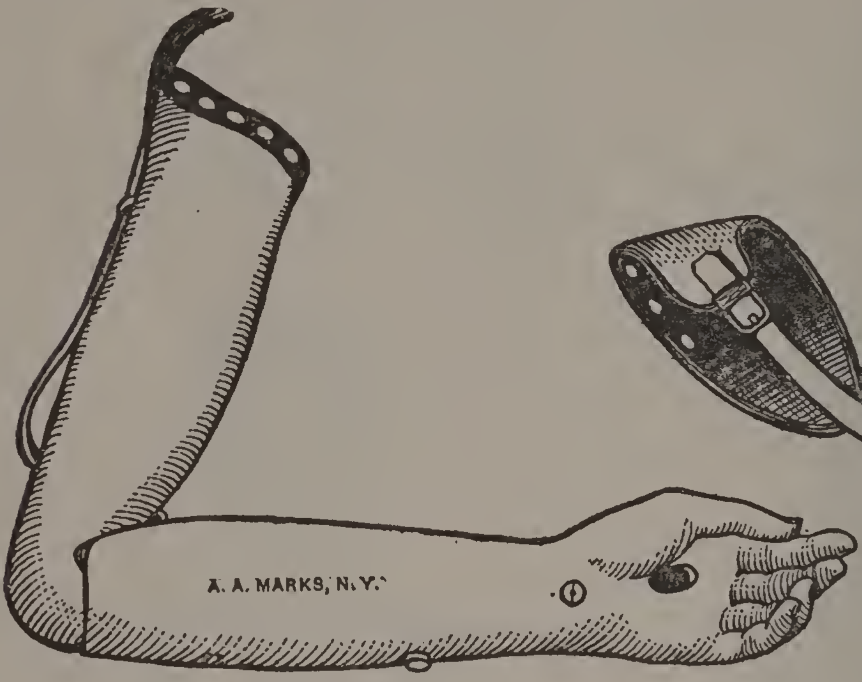


Cut T 3.

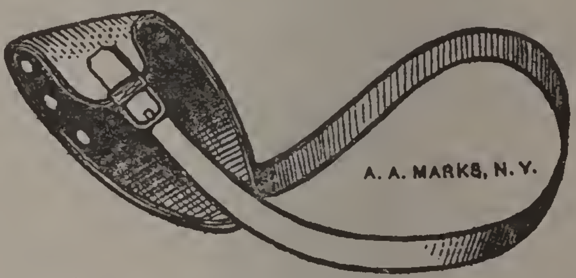
Cut T 3 represents such an arm extended at the elbow, and Cut T 4 represents it with the elbow joint flexed.

This arm is usually constructed of wood, shaped to the con-

tours and dimensions of the opposite arm, excavated to reduce weight, covered with rawhide to add strength, and enameled a flesh-like tint. The hand is of rubber, attached to the forearm by either of the methods heretofore described. The palm is provided with a locking arrangement for holding laboring, eating, and other useful implements. The joints at the elbow are of a



Cut T 4.

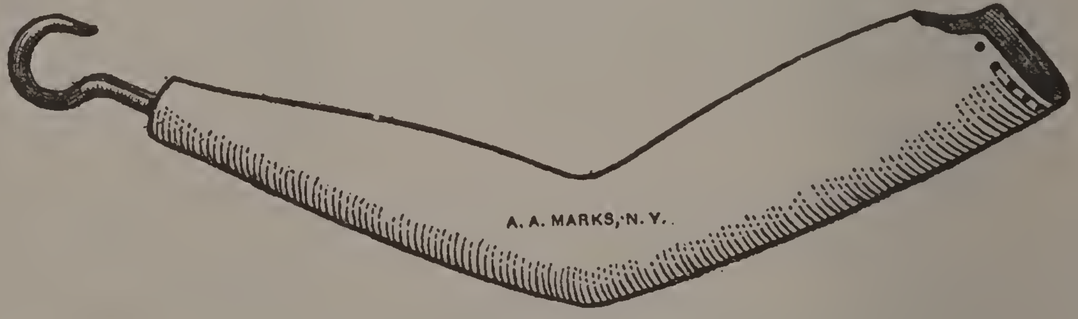


Cut T 5.

substantial character, combined with an attachment that will hold the forearm at one or more desired angles.

Elbow Lock.—The locking arrangement is released by pressure applied to button protruding from the under side of the forearm. Suitable suspender is represented in Cut T 5. This can be renewed, as occasion may require. By an ingenious attachment rotation of the elbow is obtained when length of stump will permit.

Peg arms for upper-arm amputations are of several kinds. Cut T 6 represents the least expensive. It is usually made of wood, excavated to receive the stump properly and to reduce weight, and



Cut T 6.

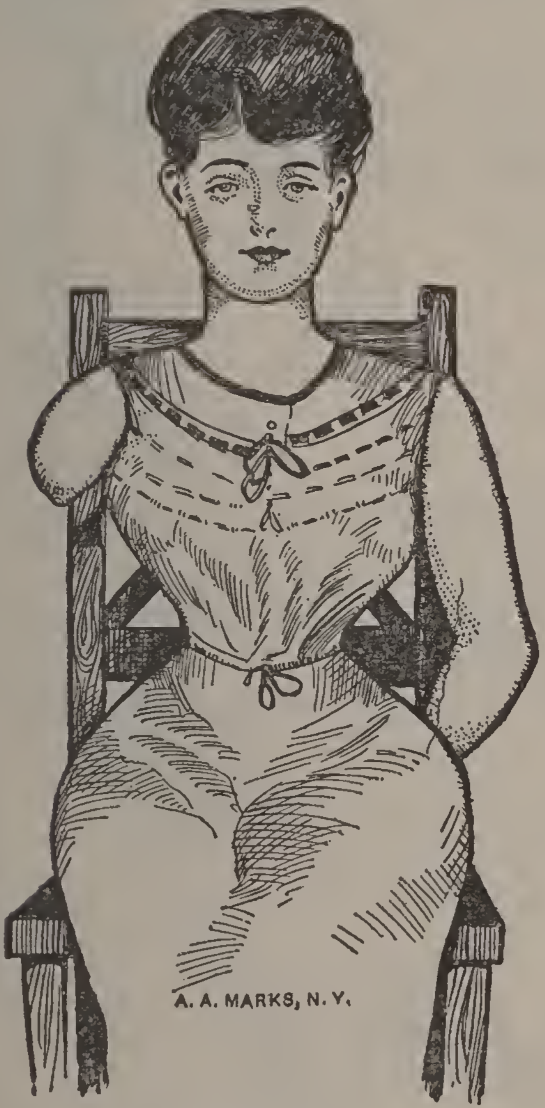
shaped on the outside to have the form and dimensions of the opposite arm. The end of the socket is provided with a catch that will hold implements of utility. This arm is partly flexed and immovable at the elbow, as it is found to be more convenient that way. If a peg arm with elbow-joint motion is wanted, it becomes the same as T 4 without a hand.

CHAPTER XXV

SHOULDER-JOINT AMPUTATIONS

Amputations that are made in the shoulder joints leave short muscle stumps or no stumps at all. They require artificial arms the same as when amputations are between the elbow and shoulder joints.

Cut U 1 represents a shoulder-joint amputation, leaving a muscle stump. Cut U 2 shows a shoulder-joint amputation with



Cut U 1.

Cut U 2.

no stump, and Cut U 3 represents a congenital malformation, the clavicle turned upward at its extremity, affording a knob, or prominence, on which an artificial arm can be securely adjusted.

An artificial arm constructed on the plan of that represented in Cut U 5 is suitable for any of the above cases. The manner in which it is applied and held by body strap is shown in Cut U 4.

Artificial arms are quite necessary in shoulder amputations or

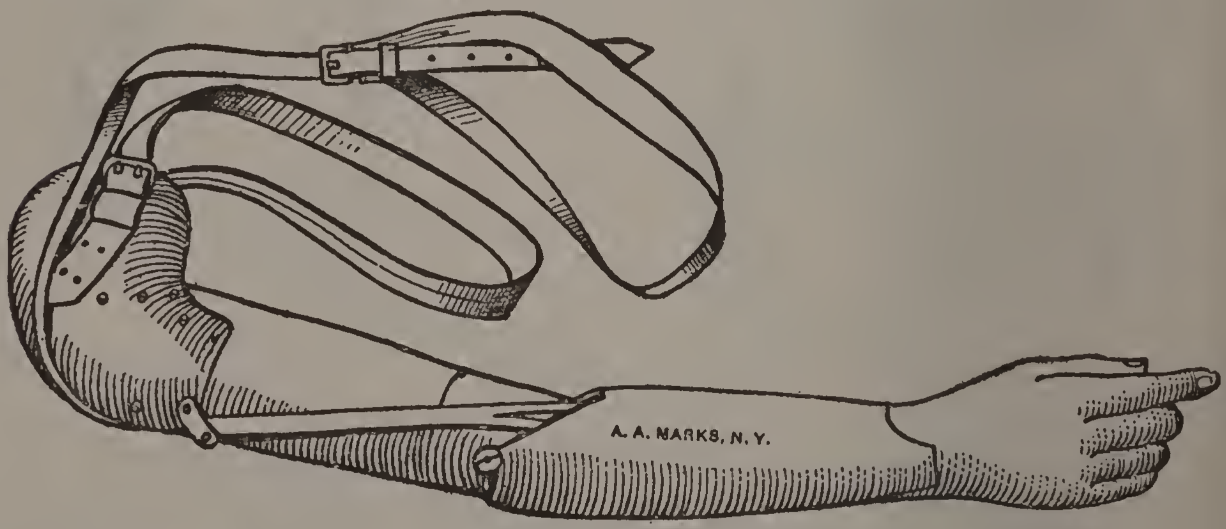
malformations; they keep the shoulders in position, restore symmetry to the body, and provide a means for assisting the other

Cut U 3.

Cut U 4.

arm. By a shrug of the shoulder, the artificial arm is thrown forward, the flexion strap is contracted, and the elbow bends.

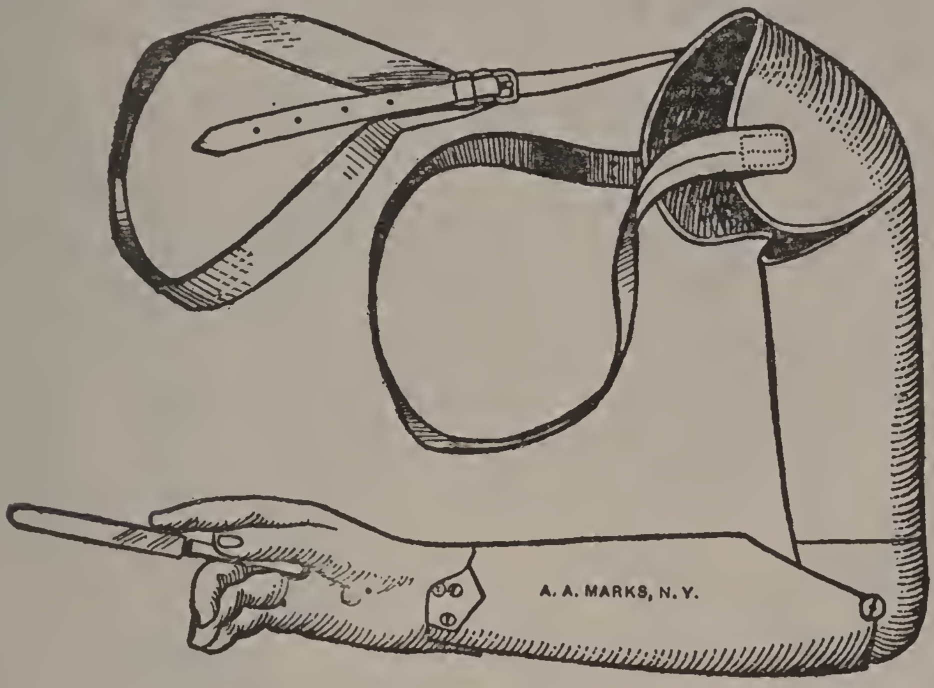
Young persons become very dexterous in manipulating arms under these conditions; they have been known to operate them so skillfully that few persons ever suspect the arms to be artificial.



Cut U 5.

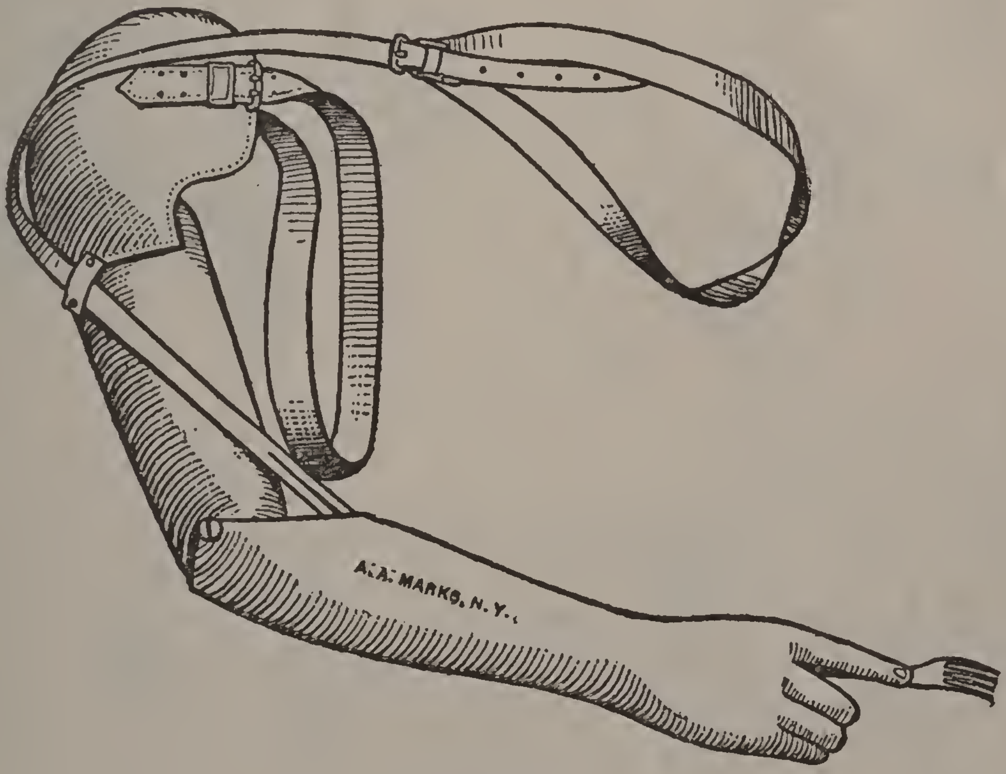
Artificial arms for shoulder-joint amputations are constructed essentially the same as those for amputations between the elbows and shoulders. In addition to the usual stump socket there is a

pad that runs well above the top and over the shoulder, resting on the shoulder close to the neck. The stump is held in position by a strap passing around the body under the opposite arm. The elbow joint admits of flexion and extension, and is provided with



Cut U 6.

a locking arrangement that will hold it at right angles. The attachment can be released by pressure applied to a press-button immediately under the forearm. Cuts U 6 and U 7 represent the arm flexed at right and oblique angles.



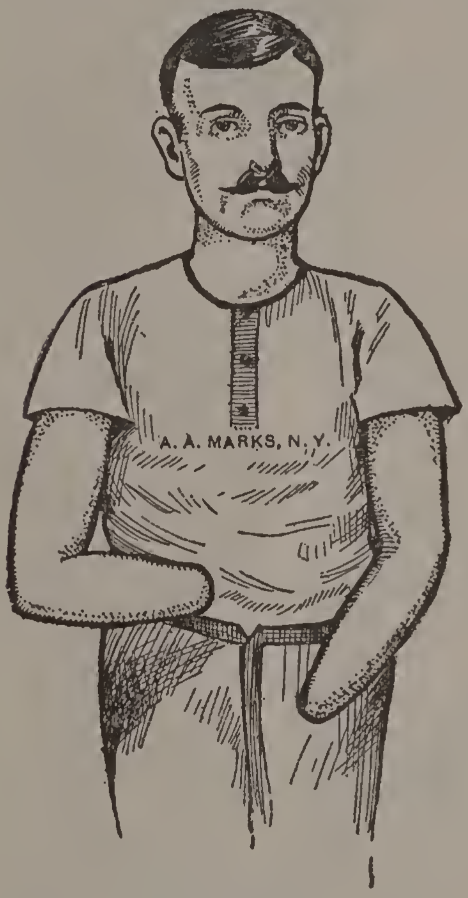
Cut U 7.

Peg arms for shoulder-joint amputations are practically the same as those for above-elbow amputations, and are described in previous chapter.

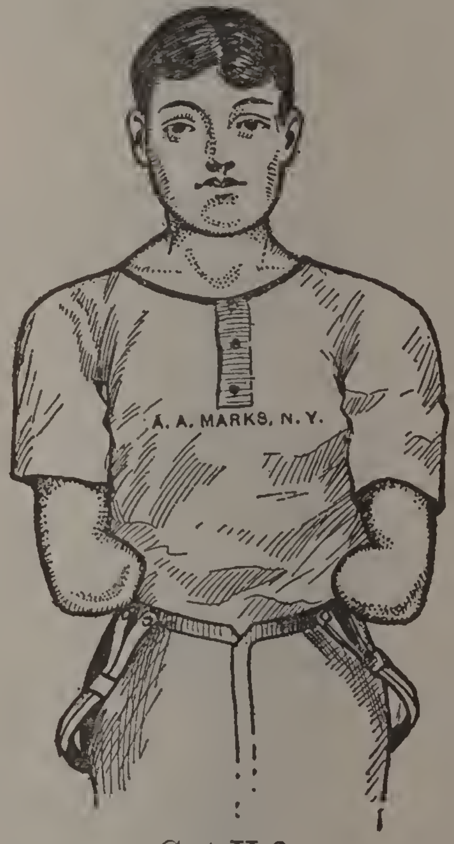
CHAPTER XXVI

DOUBLE ARM AMPUTATIONS

The amputation of both arms is a deplorable loss and presents the strongest appeal to the artificial limb maker. The subject is absolutely dependent upon others unless artificial arms are applied. He is neither able to feed himself, prepare his food, dress himself, or perform labor of any kind. Something must be done to better his unfortunate condition. If not, he is obliged to remain dependent upon some kindly disposed friend or relative. Anything that



Cut V 1.

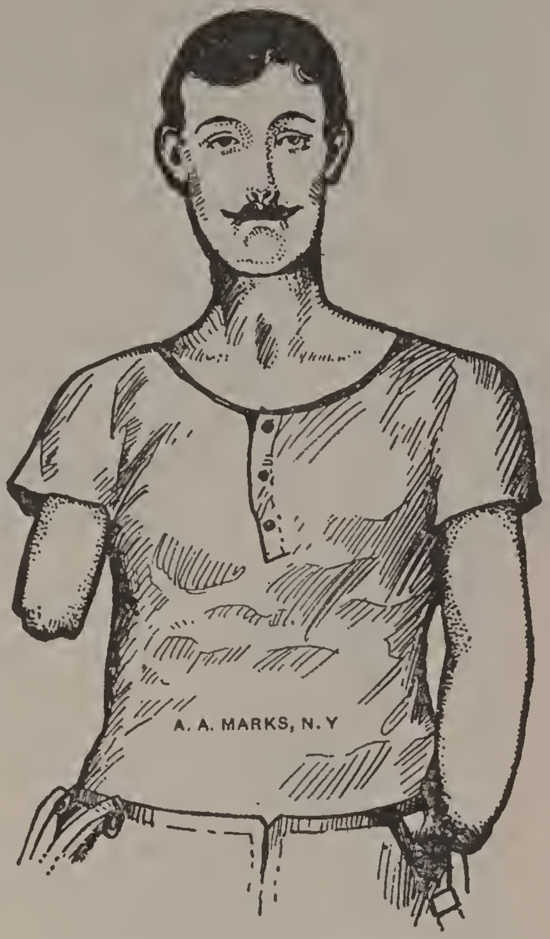


Cut V 2.

will help him in his condition, no matter how little, will be a benefit and will materially lessen the burden on others.

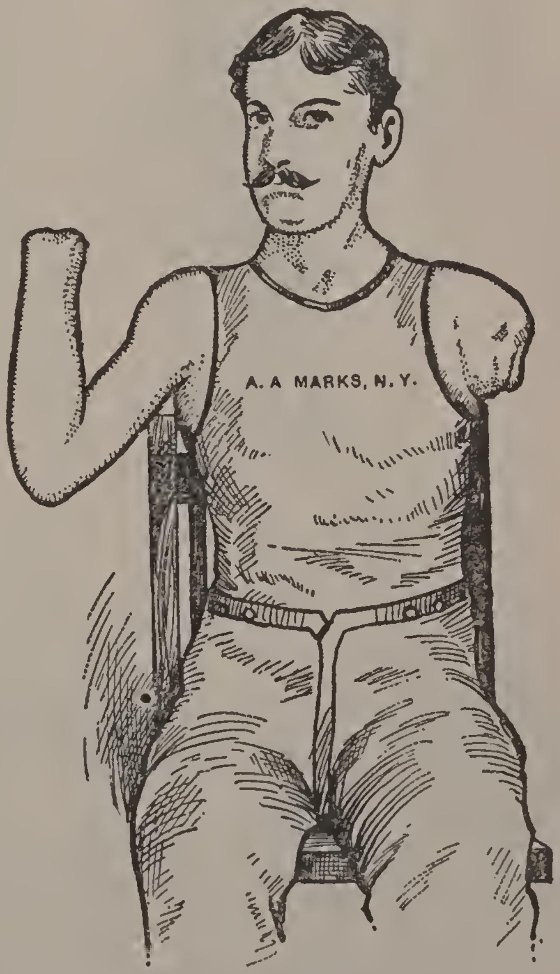
Cut V 1 represents the amputation of both forearms, leaving stumps that are long and powerful. Cut V 2 represents double forearm amputations, stumps short. Cut V 3 shows artificial arms applied. Artificial arms, under control of long and powerful stumps, will enable the wearer to prepare his food at the table, convey it to his mouth, perform labor of a great variety, carry articles of considerable weight, write a legible hand, open and close a door, and attend to the adjustment of his own attire

Cut V 3.



Cut V 4.

Cut V 5.



Cut V 6.

to a reasonable degree. When the stumps are short, the range of utility is correspondingly lessened.

The use of spring thumbs is always desirable in double arm amputations, and unless otherwise instructed, we assume that they are wanted and construct the hands accordingly.

Cut V 4 represents double arm amputations, one immediately above the wrist, and the other above the elbow. Cut V 5 represents similar cases, with artificial arms applied.

Cut V 6 represents amputations of the right hand at the wrist and the left arm at the shoulder. A pair of artificial arms were applied to this case with gratifying results.

The right artificial arm was under control of the natural elbow. The left was secured to the stump by straps with a locking attachment at the elbow and clamp at the wrist. Considerable labor

Cut V 7.

Cut V 8.

was capable of being performed by the right, the left arm depending upon a strap passing around the body for flexion and extension of the elbow.

Cut V 7 represents a young man with both arms amputated above the elbows, the result of a railroad accident. Cut V 8 shows him with a pair of artificial arms applied. As may be surmised, the arms were of very limited use, but, nevertheless, they mitigated his affliction to a compensating degree. By the working of his right shoulder, he was able to bring the artificial forearm to right angles. In this position it would remain, pro-

viding a means by which articles could be laid on the forearm and carried. His left arm could be flexed by means of the stump, which was long and powerful. When at extension, a pail, basket, or valise could be carried, and other services performed. The arms rescued him from a life of absolute idleness.

Cut V 9 represents a man who, while attending his duties on a railroad, was overtaken by a severe storm, and before he could reach shelter, both feet and hands were frozen. It was necessary to amputate the right hand between the thumb and wrist and the left at the base of the fingers and thumb. The great toe was removed from the right foot, and left leg amputated a little above

Cut V 9.

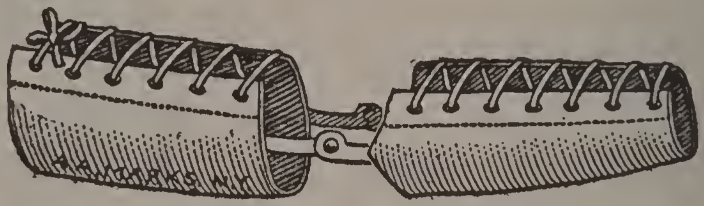
Cut V 10.

the ankle. The same cut shows a pair of artificial hands and an artificial left leg suitable for the case. Cut V 10 represents the limbs applied. Each hand had moving thumbs, which were connected with levers, operated by the forearm. When the stumps were flexed the levers would force the thumbs against the index and middle fingers. When the stumps were extended this pressure was released, and the thumb was permitted to withdraw. An artificial leg was applied to the left side. By these appliances this person was rendered capable of earning his livelihood.

CHAPTER XXVII

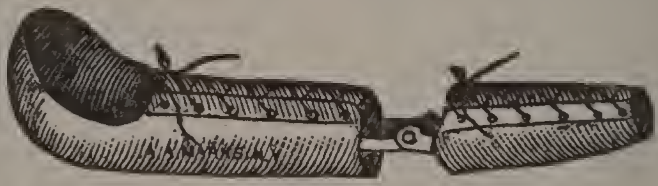
APPLIANCES FOR DEFORMITIES, EXCISIONS, WEAKENED JOINTS, ETC.

In cases of ununited fractures of either bone of the forearm or of the elbow joint or upper arm, it is necessary to apply a brace constructed upon durable lines and capable of being removed and readjusted as conditions require. Cut W 1 shows an apparatus for an ununited fracture. The forearm and muscle parts are con-



Cut W 1.

structed of material sufficiently firm to serve the purpose. They are connected by articulating joints that work in harmony with the elbow, or supply the elbow motion; the parts are adjustable by lacing, they hold the bones in place and give strength and firmness

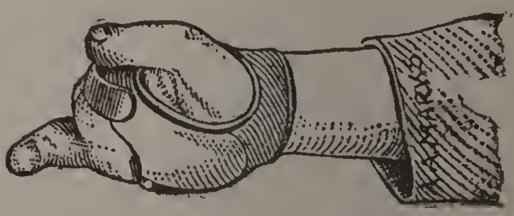


Cut W 2.

to the fractured member. Cut W 2 represents an apparatus for elbow-joint resection or for dislocated shoulder joint. The forearm and muscle parts are made of suitable material and are connected by steel joints. The muscle part is provided with a hood, which

Cut W 3.

Cut W 4.

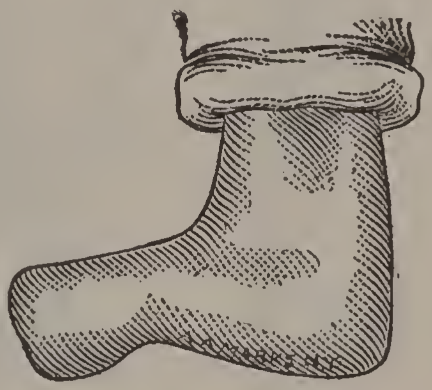


Cut W 5.

rests comfortably upon the shoulder. When necessary, a strap connected with the hood is passed around the body, holding the appliance firmly in place.

Cut W 3 represents a hand mutilation, the subject being a sailor, requiring an appliance that would enable him to hold a rope, tie a knot, climb the shrouds, and carry articles about a vessel. Cut W 4 represents a socket composed of canvas, rubber,

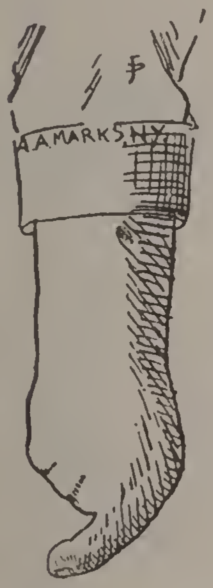
Cut W 6.



Cut W 7.

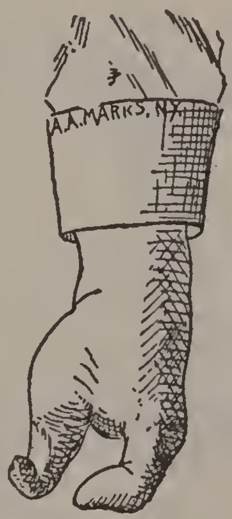
Cut W 8.

and leather, formed to fit the mutilated hand, with apertures to admit the passage of the remaining fingers; a steel, flattened hook was riveted between the apertures. Cut W 5 represents the apparatus applied, which proved to be useful and satisfactory.

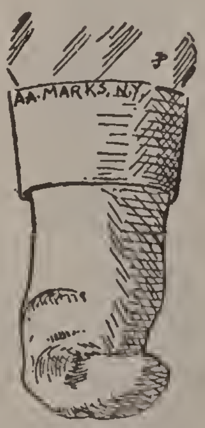


Cut W 9.

Cut W 10.



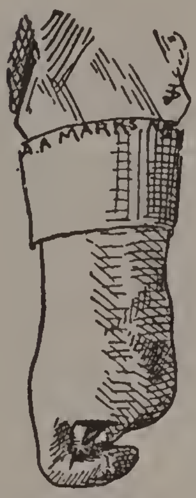
Cut W 11.



Cut W 12.

There are many cases of deformities, resections, etc., of the upper extremities that can be treated practically the same as amputations. They require artificial parts that incase the weakened members and strengthen them.

Hands and parts of hands are attached to malformed members so as to correct the deformity and supply the want to a degree sufficient to make the remaining parts useful. Cut W 6 represents a deformity of the forearm, the elbow joint possessing normal conditions. This deformity case was treated as an amputation below the elbow, adjustments to meet the peculiarities of the



Cut W 13.

Cut W 14.

Cut W 15.

Cut W 16.

stump. Cut W 7 represents a deformity of elbow joint and forearm, a very slight movement remaining in the elbow, the forearm terminating in an enlargement. An artificial arm, constructed similar to one for wrist-joint amputation, was made and applied.

Cuts W 8 to W 20 represent congenital deformities of the hands.

In these cases, the conditions being somewhat similar to ampu-

Cut W 17.

Cut W 18.

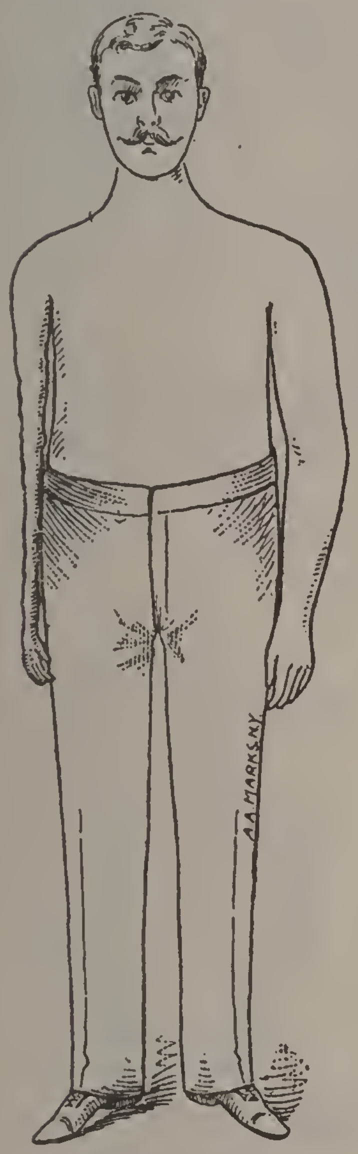
Cut W 19.

Cut W 20.

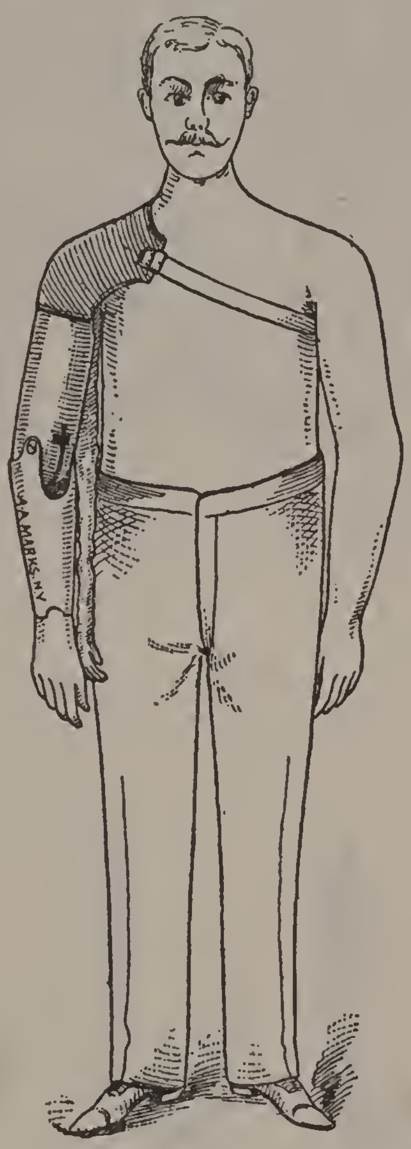
tations, artificial hands for partial hand amputations, as illustrated and described in Chapter XX., were applied.

Cut W 21 represents a European prince of distinguished lineage. When an infant, he fell from his nurse's arms, paralysis of

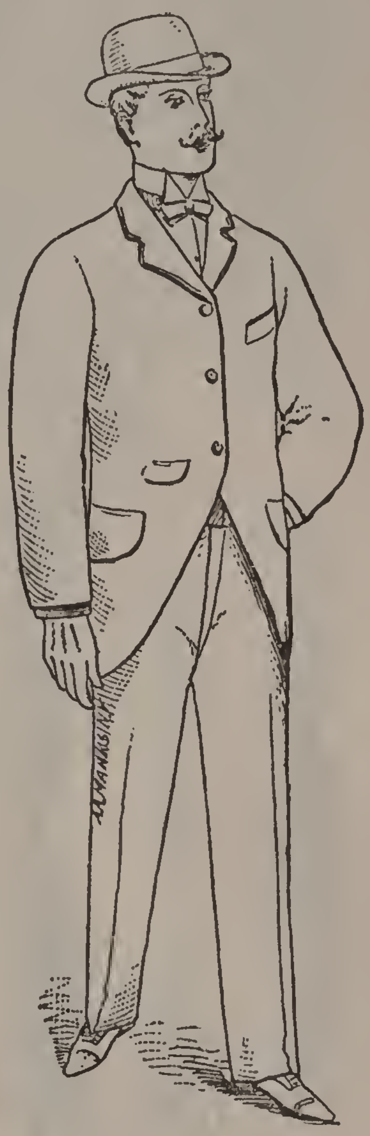
the right arm followed. As he grew to manhood, the affected member grew in length, but failed to develop in size. It was limp and useless. In 1893 he came to us, and, upon examination, we found that the entire right side of the thorax was undeveloped, and that an artificial arm could be applied without producing noticeable disproportion. The case was treated the same as a shoulder-joint amputation, and an arm constructed accordingly was attached outside the withered member. The supporting part covered a great area of the shoulder, chest, and back; this held



Cut W 21.



Cut W 22.



Cut W 23.

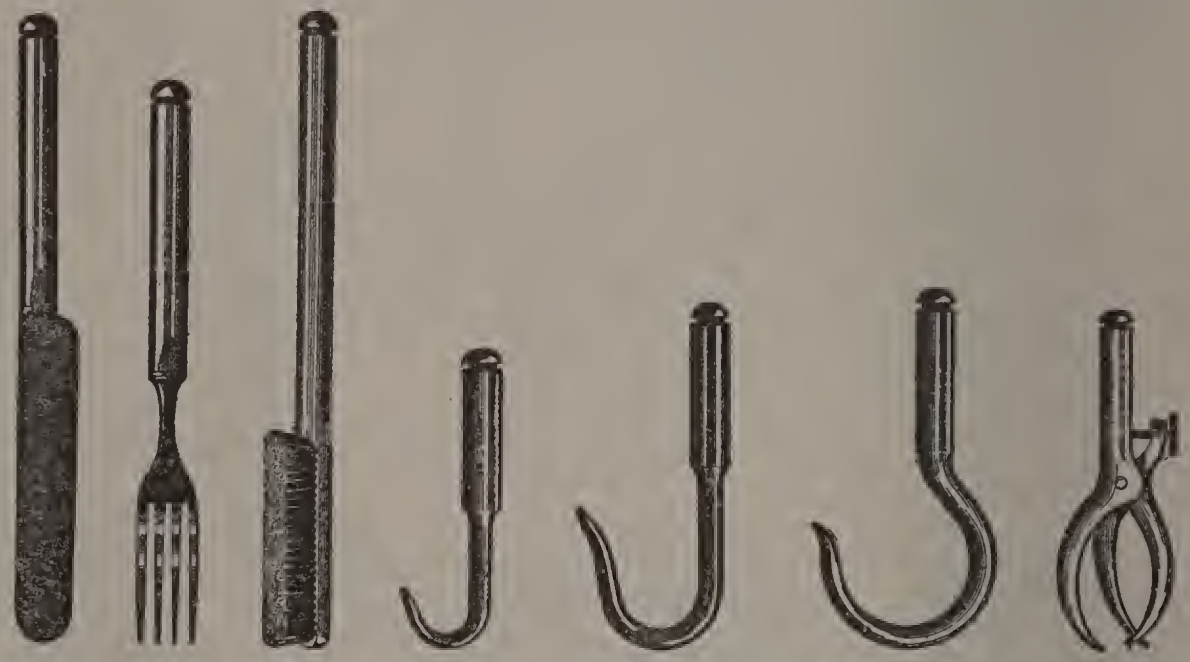
the artificial arm in place, as shown in Cut W 22. In dressing, the withered arm was (as had always been the custom) permitted to rest close to the body, the clothing was placed between the artificial and the withered arm, and, when dressed, the prince presented an appearance that was beyond criticism, as shown in Cut W 23.

CHAPTER XXVIII

ARM IMPLEMENTS

Implements for artificial arms are of endless variety: hooks, knives, forks, clevises, claw-hooks, pincers, clamp rings, are a few of the many devices that have been made for persons whose occupations demand something aside from the usual line. Each arm we make is supplied with a hook, knife, fork, and brush. These are included in the cost. Additional implements are furnished when desired, and if a customer desires one made to order for any special purpose, we will gladly make it for him. Our charges for the same will be moderate.

Cut X 1 represents a table knife, Cut X 2 a table fork, Cut X 3 a hand or nail brush; these are fitted to slip in the palm of



Cuts:

X 1. X 2. X 3. X 4. X 5. X 6. X 7.

hand or in the end of the forearm. They are of great assistance at the table and in washing the opposite hand.

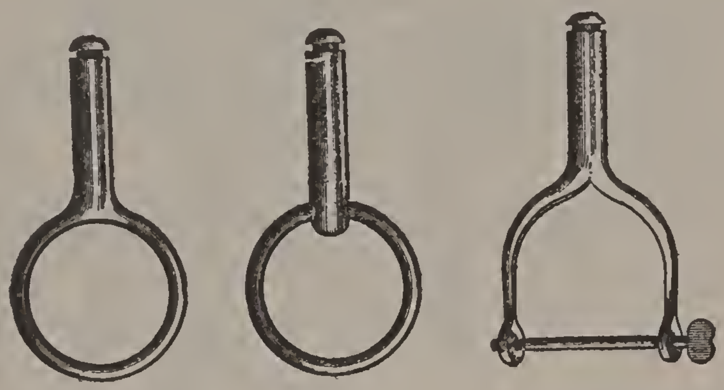
Cuts X 4 and X 5 are hooks to be carried in the palm of the hand or in the end of the forearm. They are made with straight shanks, so that they can be received in the palm, are of two sizes, large and small, as shown in the illustrations.

Cut X 6 is a round hook, to be used in the end of the forearm. The curved back prevents it being placed in the palm of the hand. Cut X 7 is a claw hook, to be used in the end of the forearm. One part is made with two prongs and the other with one; it can

be opened, closed, and set. This device enables a mechanic to clasp a tool with firmness.

Cuts X 8 and X 9 show rings which can be placed in the end of the forearm. One is immovably attached to the shank, and the other is loose; either is serviceable for mechanics and farmers. Through the ring the handle of a tool, or farm implement, can slide, while the tool is directed by the opposite hand.

Cut X 10 shows a clevis to be used for holding shop or farming implements. A quarter-inch hole must first be bored through the handle of the tool to be held, then the pivot pin unscrewed and the clevis placed over the handle, the pivot pin passed through one tine of the clevis, through the hole in the handle, and then



Cut X 8. Cut X 9. Cut X 10.

screwed into the other tine. This will hold the tool in an accommodating way, and permit it to swivel.

CHAPTER XXIX

UTILITY

Although claim is not made that an artificial arm possesses functions comparable to those of the natural, it is contended that a reasonable and a compensating amount of utility is assured.

The wholesome effect an arm has on the stump, that of keeping it in a healthy and vigorous condition, protecting it from injuries, forcing it into healthful activity, together with its ornamental aspect, are sufficient reasons for wearing one, even if utility is totally ignored.

As before stated, there are persons who have more aptitude than

Cut Y 1.

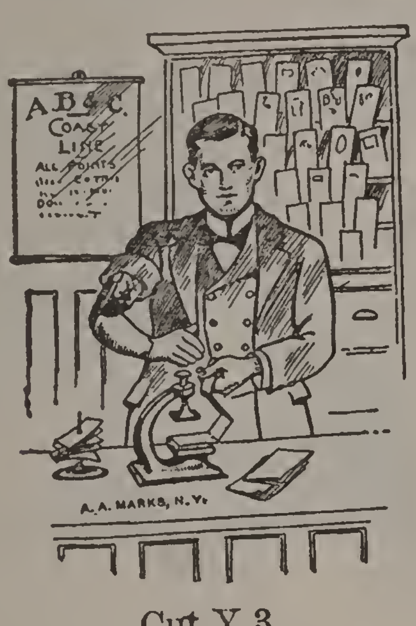
others. Some with very short stumps do more than others with long ones.

Notwithstanding how short a stump may be, there is always a possibility of its controlling an artificial arm to advantage. If one person can use an arm on a short and difficult stump, there is hope that every person can do likewise, no matter what length or kind of stump he may have.

A few cases are presented, to give some idea of the scope of the value of artificial arms from the utility point of view.

Cut Y 2.

One of our lady patrons is an amanuensis. While she is holding and guiding a pen with her rubber hand, she is keeping the paper from sliding on the desk with her natural hand. She writes



Cut Y 3.

Cut Y 4.

quickly and legibly and earns her livelihood by that employment. Cut Y 1 represents her at the desk.

One of our patrons, a physician, who is engaged in general country practice, wearing an artificial arm for amputation below

the elbow, finds his rubber hand convenient and valuable in holding the reins of his horse while driving. (See Cut Y 2.)

Mr. Woolley, of Ohio, is a ticket agent at a railroad station.

Cut Y 5.

He has held the position for a number of years to the satisfaction of the company. He holds tickets in his natural hand while he operates the stamp and dating machine with the rubber one. (See Cut Y 3.)

Cut Y 6.

Cut Y 7.

W. G. Bray, of Dunklin County, Mo., lost his arm below the elbow some years ago. He has worn an artificial one since. He is a clerk in a store and has to handle all kinds of heavy mer-

chandise. He handles a wheelbarrow to advantage. (See Cut Y 4.)

Cut Y 5 represents a customer who uses his rubber hand in rowing a boat; he is a farmer, located on the banks of a river, and finds it necessary to cross the stream frequently.

Mr. Ely, of Windham County, Conn., has no difficulty in working with other laborers and earning laborer's wages, although he has to do a great amount of work with the pickax. His right arm is artificial. (See Cut Y 6.)

A physician in Michigan writes that his patient, for whom he bought an artificial arm, has learned to operate the key of his

Cut Y 8.

Cut Y 9.

telegraph apparatus very skillfully with his rubber hand. (See Cut Y 7.)

The accompanying Cut Y 8 portrays a railroad conductor who wears an artificial arm and holds the ticket in his rubber hand while he operates the punch with the other.

A patron, residing in Providence, wears an artificial arm on a short shoulder stump; he could not be induced to do without it; it exercises his shoulder, improves his appearance. He finds the rubber hand a great convenience in holding cards while playing whist, a game he is greatly attached to. (See Cut Y 9.)

CHAPTER XXX

DIRECTIONS FOR TAKING MEASUREMENTS FOR ONE OR A PAIR OF ARTIFICIAL ARMS

Place a sheet of paper (about twenty or thirty inches) on a smooth table, remove all clothing from the upper part of the body, and place both arm and stump on this paper at full length. Be sure that the edge of the paper presses closely against the chest. Pass a long pencil down the inside of the arm (Cut Z 1), around the fingers, and up the outside to the shoulder. Then pass the pencil around the amputated side, from body around end of stump, and up to the shoulder (Cut Z 2). Bend the elbow of the sound arm to about right angles, mark from the shoulder around the elbow, down the forearm, around the hand, up the inside

Cut Z 1.

Cut Z 2.

to the shoulder (Cut Z 3). Bend the elbow of the amputated arm to right angles and mark around it, from the shoulder to the end of the stump (Cut Z 4). If these diagrams are correctly made, they will resemble Cuts Z 5, Z 6, Z 7, and Z 8.

With a tape line measure the distance from the point of shoulder to the point of elbow of the sound arm, also the distance from the armpit to the bend of elbow (indicated by dotted lines in Cut Z 7). Measure the distance from the point of the shoulder to the point of the elbow of amputated arm, also the distance from the armpit to the bend of elbow. Give the circumference of each arm at points two inches apart, beginning close to the body. These circumferences are represented by dotted lines A, B, C, D,

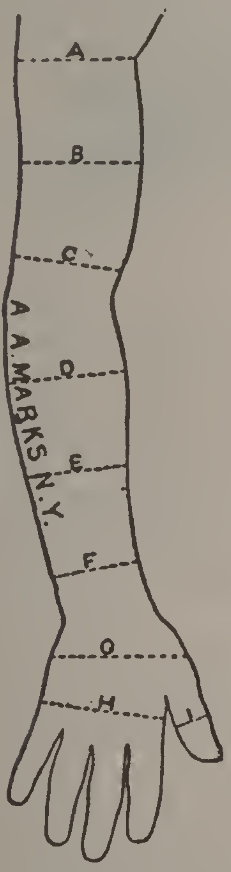
E, and F of sound arm, and the dotted lines A, B, C, D, E, F, G, and H in the diagram of the stump (Cut Z 5). Then give the circumference of the hand at the base of the thumb, the circumference of the palm at the base of the fingers, the circumference

Cut Z 3.

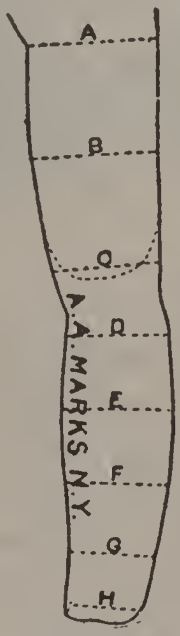
Cut Z 4.

of the thumb at the first joint, represented by dotted lines G, H, and I (Cut Z 5).

If one arm is amputated in or above the elbow, the diagrams

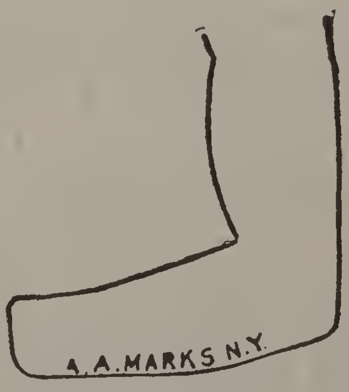


Cut Z 5.



Cut Z 6.

Cut Z 7.



Cut Z 8.

and measurements of the sound arm called for by Cuts Z 5 and Z 6 are required, and only one diagram of the stump, together with circumferences at places two inches apart, the distance from

point of the shoulder to the point of the stump and from armpit to the point of the stump are also required.

If both arms are amputated above the elbow, diagrams of each stump, and the distances from the point of each shoulder to the point of each stump, and from armpit to the point of each stump are required, also the circumferences of each taken at points two inches apart.

If both arms are amputated below the elbows, the diagrams and measurements may be taken as suggested by Cuts Z 6 and Z 8.

All amputations in the shoulders, elbows, or wrists, or in the hands, leave extremities that are bony, more or less sensitive, requiring very exact fitting. Such stumps should be reproduced in plaster.

Answers to the following questions should be attached to the blank and forwarded with every order: Name of patient? Post-office address? Occupation? Age? Cause of amputation? When was amputation performed? Which arm amputated? Has the patient worn an artificial arm? If so, whose make? Name of

Cut Z 9.

Cut Z 10.

party ordering? His address? Is the arm to be made and fitted from measurements in the absence of the wearer? To what address shall it be shipped?

Plaster casts of arm stumps are only required in amputations in the wrists, elbows, shoulders, and in the hands, and in other cases when there are peculiarities that cannot be clearly indicated by the diagrams. A dentist, wax flower maker, or plaster statuette maker is familiar with the manipulation of plaster, and if one is available he should be employed for the purpose. The operation, however, of taking a plaster cast is not difficult, and can be done by almost any person.

The simplest method is as follows: Remove all clothing, shave away all hair, or stick it down with glue, paste, thick plaster, or thick soap. Then place about two quarts of plaster of Paris in a basin containing one quart of water, stir it up thoroughly, so that the plaster will become pasty. Then spread it upon the stump, until it is entirely covered with at least one-half an inch in thickness. The stump should be kept very quiet until the

plaster has become hard, at which time it can be withdrawn, and the plaster will form a mold of the stump. This can be sent to us, or, if preferred, the inside can be greased and filled up with slaked plaster of Paris, which, when hard, can be taken from the mold.

If the end of the stump is large, or if there are prominences on the stump, it will be necessary to make the mold in two parts, so that they can be separated when hard, and the stump removed. The simplest way is to spread a little slaked plaster on the table, lay the stump upon it, pressing it down until it sinks half way into the plaster (see Cut Z 9). Then lay pieces of thin, wet paper all over the exposed surfaces of the plaster. Then pour and

Cut Z 11.

Cut Z 12.

spread plaster on the top of the stump (Cut Z 10). Let the plaster run down the sides on the paper. The stump should be covered with at least one-half inch in thickness. When it has become thoroughly hard, the piece of paper will permit the plaster to separate and the stump can be withdrawn. The mold thus produced can be sent to us, or, if preferred, a plaster facsimile of stump can be made from it, by first speading oil or grease in the mold, then placing the two parts together, tying them by a string; then mix plaster of Paris to about the thickness of cream and pour it inside the mold. When this has become hard, the mold can be separated and the cast withdrawn.

ARMS FITTED FROM MEASUREMENTS

Artificial arms can, as a rule, be fitted from measurements and diagrams, while the wearers remain at home. The same reasons that are given for fitting artificial legs from measurements apply to arms. The guarantees that we give protect the ordering party in the strongest possible way. Should an arm fail to fit acceptably, when made from measurements, it may be assumed that the stump has changed, or that there are peculiarities about the stump which have not been made known. No matter what conditions may be

responsible for such misfit, the arm can be returned, with particulars, and all the needed alterations or reconstructions will be made by us without charge, or, if the wearer desires, he can at that time call upon us and have the arm refitted and readjusted directly to his stump. It will thus be seen that the conditions under which fittings are made from measurements are entirely in the interest of the wearer. As a rule, fitting from measurements results in saving the party expense, annoyance, and loss of time in traveling.

Prices are printed on leaflet appended to the last chapter of this book.

Accessories.—Artificial arms for wrist-joint, forearm, elbow-joint, above-elbow and shoulder-joint amputations will be accompanied, free of charge, with necessary suspenders, sock for the stump, knife, fork, hook, pair of gloves, etc.

Peg arms for the above amputations will be accompanied with all the above-mentioned articles except gloves.

CHAPTER XXXI

TERMS OF PAYMENT, INSTALLMENT PAYMENTS, GUARANTEE

Advance Payment Avoids Delay.—An article so important as an artificial leg or arm, which has to be made expressly to order for the person who is to wear it, should be paid for in advance. Time and expense are saved by doing so. If, however, objection is made to paying the full amount in advance, one-half the value can be forwarded with the order and the balance paid on delivery.

How to Make Payments.—Remittances can be made by bank draft on New York, by postal money order, by express money order, or by money package by express. All drafts should be made payable to the order of A. A. Marks.

Our Reliability.—Every assurance is given that the interests and the welfare of the wearer will be subserved in every detail. Our reliability and business and financial standing can be ascertained by consulting any mercantile agency.

Success Most Important to Us.—It is of the greatest importance to us that every client shall be satisfied, not only with the fitting and construction of his artificial limb, but that he shall become clever, skillful, and dexterous in its use. He must do this in order to reflect credit on our skill. We take as much pride in the successful results of our work as do our clients.

As manufacturers, we cannot afford to neglect, or hastily dismiss a case, or show a lack of interest, or the least hesitancy in doing everything that is possible for the relief and comfort of our patrons. Wisdom compels the strictest integrity in the discharge of every obligation. Trouble and expense are not to be considered when disappointment and displeasure can be averted. No establishment can exist long that becomes careless, or allows its conduct to be criticised or impugned.

Advanced Payments Are in the Interest of the Wearers.—Payments in advance may be looked upon by some as arbitrary and unreasonable, but by the man of business they are viewed in the proper light, and not objected to. As a matter of fact, the best and most skillful services are always paid for in advance. If you wish to send a letter, you must attach a stamp to the envelope, and the stamp must be paid for when purchased, before the letter is delivered. This may appear to be a small matter, but to publishers and business men who have large correspondence, it amounts to hundreds of dollars every day. If you wish to send a telegram, you must pay for it in advance. If you want a telephone in your

house, you must pay a month's fee in advance. If you wish to travel by land or sea, you must buy your ticket before you start; not after you have finished your journey. If you want a Lorenz to perform a surgical operation, you must pay him before he leaves his home. If you want a Makart to paint your portrait, you must pay him before he will entertain your order. And so it goes, the world over. The best talent and the most skillful services are only obtainable by paying in advance for them. The richest men—the most reputable merchants—have always to yield to these terms when they seek the best.

The same can be said of artificial limbs. The best can only be obtained by meeting the maker's terms. The poorest, those made by the inexperienced, can be obtained upon any terms that the purchaser may wish to make.

The question then resolves itself into whether the applicant prefers to get the best limb, and pay for it in advance, or whether he is willing to put up with the product of an unskilled maker, merely to have his notion indulged regarding payment.

Artificial Limbs on Trial, Prejudicial to Success.—It has been said that "things that are not paid for are good for nothing," and, as a matter of fact, articles that are constructed and sold under the consideration that they can be accepted or rejected, are, as a rule, rejected. It is safe to estimate that at least seventy-five per cent. of the artificial limbs that are made and delivered by small, inexperienced, and eager manufacturers, with the understanding that they can be tried for a reasonable length of time, and if not satisfactory, can be returned, are thrown back on the hands of the maker, and as these terms are only allowed by the maker of small means, he cannot afford to lose the time and material expended in the rejected limb. He, therefore, makes some slight alterations in the limb, and passes it to the next victim. There is, therefore, a strong probability, when placing an order with a manufacturer who permits his work to be returned, of getting a limb that was originally made for some other person.

Why Correctly Made Limbs are not Always Pleasant at the Start.—An artificial limb, no matter how scientifically it may be made and correctly fitted, is not a very comfortable article to wear during the period required to get accustomed to it. During this time there are many moments of discouragement. The stump, being weak, soon tires and fails to control the limb, and because of this weakness, the wearer gets discouraged and either concludes that the limb has not been properly made and fitted, or that his stump is of a character that will never control one. If the leg is not paid for, it will in all probability be rejected and returned to the maker during one of these periods when the wearer is in a discouraged frame of mind.

Patient Endeavor Brings Its Reward.—If, on the other hand, the limb is paid for, the effort to wear it will be repeated again and again, until finally the task is accomplished, and the services derived will prove to be valuable beyond calculation. Viewing the

subject in this aspect, it will be seen that the fact that the limb is paid for has a stimulating effect on the wearer, impelling him to put forth further effort.

Money Deposited in Banks Not Acceptable.—The proposition to place money for the payment of the limb on deposit with some bank, to be paid to us as soon as the limb is received and found satisfactory, is often made. We invariably decline to accept such terms, as money deposited is subject to such conditions that the feature of security is removed. The money cannot be drawn, unless the party ordering the limb gives his consent. If he declines to accept the limb from caprice, or hasty judgment, he can demand his money, and we have no redress.

Installment Payments.—We are willing to accept payments on the installment plan to accommodate those in indigent circumstances, provided such obligations are imposed as will make the payments absolutely sure from the legal point of view. On an order for an artificial leg the first payment must be at least one-third its value, and for an artificial arm, one-half its value; and this amount must accompany the order. The balance can be paid in large or small amounts—weekly, monthly, or at other periods—as may be desired. Deferred payments must be secured by the indorsement of a reliable business person who has an acceptable mercantile rating.

Deferred Payments Must Be Guaranteed.—The deferred payments can be made by promissory notes, one note for each payment, signed by the party ordering the limb, and also by the party offering himself as security, or they can be secured by a letter written by the party guaranteeing the payments. The following is an example that will be acceptable:

Place.................. Date...........

A. A. Marks, New York:

Dear Sir—Mr. .... desires to procure from you an artificial leg, and wishes to pay for the same in the following manner: .... dollars will be advanced with the order and .... dollars will be paid at the rate of ten dollars per month, beginning one month after the delivery of the leg.

In case of failure to meet the payments as agreed, or in case of default due to any cause whatsoever, you may hold me responsible, and upon demand I will pay the same to you.

Signed ....

Post-office address, ... Occupation, ...

Acceptable Guarantors.—We know no mercantile agency that quotes the financial standing or business liability of professional men, such as ministers, lawyers, doctors, farmers, retired men, employees, or agents. Mercantile agencies only give the standing of credit of those who are actually engaged in commercial or manufacturing industries. For this reason, we require the signature of a person engaged in business.

We believe there are but few dishonest persons; those whose motives and impulses are entirely void of integrity. Promises are made in good faith, but because of inability to keep them, they frequently go by default. A man without means, and being in need of an artificial leg, will assume almost any obligation, in order to procure one. He has the promise of a situation as soon as he can go without crutches. The future is promising and bright. He will go to his minister, or to his doctor, or his legal adviser, and as a rule, he will receive his favor. The clergyman or the doctor will promise to go security for him. The limb is obtained; the man wears it; he gets the situation, and earns fair wages; he becomes a little careless in his expenditures, or some relative or friend becomes afflicted and requires some financial help from him. The time arrives for payment to be made, and the young man has no money. The minister, or the doctor, who has guaranteed the payments, feels that it is unjust to be called upon to make payments. He writes a pitiful letter, and time is extended. This is repeated until patience becomes exhausted, and drastic measures have to be resorted to. It suddenly dawns upon the manufacturer that it would be poor policy to force payment out of the minister, or to make enemies with the doctor, and the matter is dropped, the manufacturer suffering the loss.

This is an old, old story, so often enacted in life that the manufacturer has been forced to accept no guarantors, except men engaged in business who have acceptable mercantile standings, and are prepared to meet losses, should the party default.

Our Guarantee.—Every artificial leg or arm delivered by us is accompanied by a guarantee giving the assurance to the wearer that the artificial limb is constructed of the best material, and in a thoroughly workmanlike manner, and if any defects present themselves, we obligate ourselves to remove them without charge, provided the limb is delivered to us as soon as the defects have become known, and before the limb has become further damaged on account of being worn when out of order. The guarantee covers a period of five years from date of delivery.

CHAPTER XXXII

PENSIONERS OF THE UNITED STATES ARMY AND NAVY FURNISHED WITH ARTIFICIAL LIMBS AT GOVERNMENT EXPENSE

The Original Law.—It has been the purpose of the United States Government, since the early part of the Civil War (1862), to furnish artificial limbs to those who lost their natural ones from injuries received while in service. The first law, passed in 1862, gave one limb for each amputation, and to soldiers and sailors only. It was soon amended so as to include officers.

The Amended Law.—In 1870, a new law was passed, which increased the number of those entitled to artificial limbs, and repeated the issue every five years. This law was in force for twenty years.

The New Law Now in Force.—In the early part of 1891 Congress enacted additional pension laws, and added to the list hundreds of thousands of soldiers who had never before received pensions, and who had never dreamed of receiving any. The same Congress adopted measures by which additional benefits were given to the beneficiaries of the artificial limb laws. The old law was amended so that the issue was changed from five to three years. This was done not because soldiers required new limbs so frequently, but as an additional gratuity to the maimed. The law, as amended, reads as follows:

"Every officer, enlisted or hired man, who has lost a limb or the use of a limb in the military or naval service of the United States is entitled to receive, once every three years, an artificial limb or apparatus. The period of three years is reckoned from the last maturity subsequent to March 3, 1888."

Those whose maturity under the old law occurred between March 3, 1886, and March 3, 1888, were given a new date: namely, March 3, 1891 (the day the bill became a law).

Transportation Free.—Necessary transportation to the manufacturer is only issued when the order calls for an artificial limb to be made by the government manufacturer who is located the nearest to the applicant; if the limb chosen is to be made by a manufacturer more distant, transportation will not be given, but the order will be issued just the same, provided the applicant is willing to have the limb constructed from measurements or will pay his own traveling expenses.

The Bond.—As manufacturers to the United States Government, we have met the requirements of furnishing bonds with two sureties, of five thousand dollars each, for the faithful performance of our work.

A blank application for an artificial limb and transportation will be sent upon request. The same can be filled out, signed, and mailed to us. As soon as we receive it, we will ascertain the date that the applicant will be entitled to a new limb, and at the proper time will pass the application to the proper officials.

Those who reside at a great distance, and do not care to travel, can remain at home and have their limbs constructed and fitted from measurements. We extend to them every protection, every assurance, every guarantee, and assume every risk, exactly as we do to civilians.

We have on file the measurements, diagrams, records, and dimensions of all the artificial limbs made by us since the founding of our house, and can duplicate any limb at any time.

If a soldier wishes to have a limb duplicated, he will not be required to send any additional measurements.

We advise pensioners to procure artificial limbs under the laws, and apply for them promptly upon the maturity of their claims, and lose no time.

When Congress makes changes in any law, the law in force up to that time becomes null and void. No one can predict what Congress will do, any more than he can predict what public sentiment will be on any issue. Should a party clamoring for extreme economy in the administration of public affairs become dominant, there is no telling what would be done in cutting down allowances.

Advantages in Registering with Us.—As pensioners seldom keep records concerning themselves, we make it a point to notify them a little prior to the date of their maturity. Any change, or threatened change, in the law affecting the issue of artificial limbs is watched by us and communicated immediately to those on our records whom the law may affect. It is, therefore, to the advantage of the pensioner to keep within touch of us; to inform us of his change of address, and to see that our records are complete, so far as rank, company, regiment, number of pension certificate, etc., are concerned.

Those Amputated in the World War.—Those amputated through injuries or other causes in the World War are entitled to artificial limbs, supplies, socks, suspenders and all other appurtenances as frequently as they are needed. The issuing of orders for artificial limbs as well as supplies is invested with the Veterans Bureau of the Public Health Service. This service has centers in many places in the United States. Each beneficiary is required to apply to the Bureau nearest to him. Present himself for examination and if his needs are actual the Bureau will issue an order on any artificial limb maker for such requirements.

CHAPTER XXXIII

CHEAP ARTIFICIAL LIMBS

From the International Journal of Surgery

Cheaply Made Limbs Not Safe.—From time to time the newspapers chronicle severe accidents happening to the wearers of artificial limbs as the result of faulty construction. Here is an instance taken from the Cincinnati *Enquirer* of December 19, 1901:

"Fred Rentz was severely injured last evening, about five o'clock, by falling on the street at Central Avenue and Liberty Street. His fall was due to a cork leg breaking. The unfortunate man was taken to a hospital by Patrol No. 5."

Inviting Disaster.—There is material in this brief item for profound thought on the part of every man who has occasion to require an artificial leg. There is material, too for a sermon on the iniquity of dealers who sell artificial limbs of inferior or defective workmanship. That there are many persons who commit the folly of risking their bodies, and possibly their lives, upon poorly made limbs for the sake of the few dollars saved thereby, and that there are dealers who are willing to encourage them in this folly, may be proved to the satisfaction of anyone who will read the daily papers carefully. Every few days cases are reported similar to the above, and in almost every case the disaster may be traced to the same cause—poor material or inefficient workmanship.

Mr. Rentz undoubtedly wore a cheap leg—cheap in construction, but very costly in the price he ultimately paid for it in money, suffering, and lost time. Some weakness in the wood or leather or steel (there is no cork in any artificial limb) was revealed by an accidental slip which brought an unusual strain upon it, and caused it to give way just when he had most need to rely upon it. The saying that "no chain is stronger than its weakest link" applies with the fullest possible force to an artificial leg. Every part may be perfect except one, and yet that one is certain to precipitate a fall of serious if not fatal results.

The adage that "the best is the cheapest" applies to almost everything that one may require. It applies without exception to the purchase of artificial limbs. The steeplejack will not make use of a cable unless he knows that it has been tested and proved to be capable of sustaining the weight that he will bring to bear upon it. The caisson worker will not descend below the bed of a river unless he is assured that the air-pumps are in perfect working order. No more should the wearer of an artificial limb trust him-

self upon it unless proved material, skill, and honesty have entered into its construction.

Confidence Necessary to Success.—The essence of success in walking with an artificial leg is confidence. To learn to manipulate the limb is a very simple matter, but unless the wearer knows that he can rely upon it as thoroughly as he would upon his natural legs he will never be able to walk well or to move about with a sense of perfect freedom. There are thousands of persons walking about to-day on Marks' artificial legs whose intimate friends are not aware that they have lost any of their natural members. They do not limp or hobble, and they do not find the slightest difficulty in moving about as freely as their most active neighbors—all because they have confidence; they know that every bit of material that enters into the leg is carefully tested and proved before it is used, and that, therefore, it cannot possibly give way under ordinary use or at some critical moment when they most need its support.

A vast amount of care and trained ability enters into the construction of a thoroughly reliable artificial leg, foot, or arm. It will not be sufficient to use ordinary material, or even the best material that can be bought through the ordinary channels of trade.

Selection of Material.—As the first step in the manufacture of the artificial leg, an expert visits the woods and selects the tree from which the material is to be cut. To do this is no easy matter, and requires long experience. The tree must be neither too young nor too old. It must be free from knots and must have a firm, even grain that it will be equally strong in every part.

When the tree has been felled it must be cut into lengths and carefully split into sections, use being made only of the main body of the tree trunk in which the grain is firm and even. Only a small portion of the ordinary tree is available for this purpose.

When the wood has been thus carefully selected, it is by no means ready for use. It must then be kiln-dried, so as to be thoroughly shrunk before it can be utilized. About four years is required in this process before the stick of timber can be manufactured into an artificial leg.

It is not the wood alone that is selected with such careful attention to its strength and wearing qualities. The steel which goes to form the braces and joints of the leg is first carefully tested to detect the existence of any flaws or defects and to prove that it is capable of carrying a larger weight than it will be called upon to support.

The leather for the jacket which forms the upper part of the leg is selected with equal care. Only the strongest and most valuable parts can be used; the rest must be thrown away or used for some other purpose. The buckskin lacings are also a matter of solicitude, and are subjected to thorough tests to determine the weight they will sustain.

Even a more delicate matter is the proper vulcanizing of the rubber foot which plays an important part in every successful artificial leg. The elasticity of the foot depends upon the exact

degree of heat applied to the rubber. Thus, at every step in the selection of material, the greatest care and judgment must be exercised.

The need of practical experience and expert judgment does not end with the selection of materials. Equal skill is needed to assemble them properly. An artificial leg, to be a source of comfort and usefulness to its wearer, must fit perfectly, and no two persons can be fitted by exactly similar legs. The highest skill of the artisan is required to meet and make allowances for all the little peculiarities of each individual wearer. It is ridiculous to assume that it is possible to fit all comers with artificial legs simply by carrying a few sizes in stock.

The worst mistake that the prospective purchaser of an artificial limb can make is to patronize one of the cheap establishments which are continually being started by disgruntled apprentices or discharged workmen. It seems incredible that a man who will not permit his horse to be shod by an incapable blacksmith, or his beard to be trimmed by a man of no experience as a barber, will nevertheless trust the delicate and vital task of supplying an artificial limb for himself or a member of his family to a crude bungler or a cheap mechanic. Yet such cases come to notice frequently. Too late, when permanent injury has been done to some delicate blood vessel or tender nerve center, or when a bad fall and broken bones have taught the lesson that better counsel might have imparted in the beginning, he turns to the firm that has a long-established reputation for efficiency, reliability, and honest dealing.

How much better—yes, how much cheaper—it would be to intrust one's self in the beginning to a firm the members of which have gained a thorough knowledge of the subject through a business experience of years, which spares no expense to secure the most perfect materials for its artificial limbs, which employs the most carefully trained and thorough workmen, which owns the most important and successful patents for artificial limb appliances, and the name of which is a guarantee of good faith, good workmanship, and satisfaction to its customers!

CHAPTER XXXIV

DO THE MAIMED DIE YOUNG?

A False Belief.—There appears to be a belief, shared by the medical profession as well as the laity, that the amputation of one or more of the limbs from the human body necessarily curtails the allotted years of man, that there is a law that establishes a ratio between the length of the life of the normally equipped man and that of the dismembered one. That the ratio is according to the extent of the dismemberment. If a man is born to live three score and ten years, provided he retains all his limbs, the loss of one limb will take, say, ten years from that allotment; and if he loses two limbs the lopping off of a few more years will be the consequence.

What Our Records Disclose.—During our career as protheticians we have had opportunities to investigate. An examination of our records, which comprise the histories of many thousands of maimed persons, has led us to the conclusion that the dismembering of the human body plays no part whatever in shortening life. Our records date back to 1853, and it is a fact that, of the entire number of our patrons, less than twenty-five per cent. have died, and most of those have died from old age or accident, and in no case can we learn of a death that can be directly ascribed to the loss of a limb. We know of very few persons wearing artificial limbs who have suffered or died from pulmonary or cardiac diseases, and those who have fallen under those diseases were affected before their limbs were amputated. It is not an uncommon occurrence for octogenarians who have been our patrons for years to order new limbs, expecting to live long enough to wear them out.

Amputations Revitalize the System.—As we investigate this subject more thoroughly we are persuaded that amputations revitalize the entire person, and render it not only possible but probable, that, on account of amputations, the lives of the subjects will be prolonged, comparatively immune to disease.

It is obvious that diseased and mangled limbs that cannot be cured will cause death if they are not removed; but this is not the phase of the question we are discussing. Will the length of life of the person who has had his limb removed on account of disease or injury be less than it would had his limb never been diseased, injured, and amputated? While it is absolutely impossible to give a direct reply to this question we believe, and we say it with all sincerity, that the compensation for the loss of a limb lies in assured good health and prolonged life. Numerous instances support this belief and many of them are of national reputation.

ILLUSTRATIONS.—Rev. Edward Beecher reached the age of eighty-four. Evidences of senility were apparent. By making a false step he fell from a railroad train and had one of his legs so badly crushed that it had to be amputated. He recovered from the operation and had an artificial leg applied. He lived for eight years and enjoyed excellent health and remarkable physical strength and mental energy. It was his custom to take long walks every day, to preach sermons on Sundays, lead prayer meeting during the week, and in fact, perform all the duties expected of a clergyman. From the moment he recovered from the accident that deprived him of his leg, new life and renewed energy came to him. He was a stronger, healthier, and more sprightly man after the accident than he had been for a number of years prior to it.

Governor Wade Hampton lived to be an octogenarian. He had a leg amputated a number of years before and wore an artificial one up to the time of his death. He was up to the last moment mentally and physically strong.

John Pearson lived to be eighty-five years of age. He lost a leg when seventy, recovered quickly, obtained an artificial leg, enjoyed vigorous health, giving his time to his railroad interests almost up to the moment of his death. General Butler, General Wager Swayne, and scores of others have more than fulfilled the biblical allotment and enjoyed many years of active life after having been deprived of one of their limbs.

It is a remarkable fact that there are very few maimed persons in insane asylums. Records of suicides are almost free of the crippled. The mental as well as the vital forces appear to become stimulated by the dismemberment.

ATHLETES.—Dare, Melrose, Conway, Leland, and Fitzpatrick are one-legged acrobats whose muscular developments are the envy of the world. Few possessed of natural limbs can vie with them in athletic activities.

It is a noticeable fact that persons who lose their legs become powerful in their arms, large in chest and girth, and persons who lose their arms become powerful in their legs and large in girth. The loss of one part of the body stimulates the growth of the remaining parts.

COMPENSATION.—A reasonable explanation may be found in the hypothesis that the removal of a part of the body lessens the demand on the vital forces and permits the supplying reservoirs to contribute more abundantly to the remaining members. If it overtaxes the heart to force the blood through all the avenues of the body, will not its labors be lessened if some are cut off? And will not the remaining avenues receive a larger share of the life-giving essences? If the nervous system is taxed to its limit, will not the tax be lessened if a part of the nerve organization be removed? If a tree is permitted to grow unpruned, it will sap itself by many choking branches and the trimming up of the limbs always gives vigor. The tree will grow larger, stronger, and will live longer.

It has been said that a maimed person takes care of himself, does not expose himself to the elements, or to the dangers that beset other human beings; that on account of being crippled, he is compelled to be more cautious than others; he cannot indulge in the riotous, inebriate course which wrecks so many lives. In this connection we will say, and we speak from knowledge, that a person who is deprived of one or more of his limbs is not necessarily a convert to a life of virtue. He is not always the sober man, the epitome of morality that some persons think he is. He goes through life in the same careless manner as other healthy mortals, doing what he ought to do, and many times what he ought not to do. He sometimes observes propriety, but oftentimes is as reckless as his companions. There are, however, many maimed persons who are sober, industrious, thoughtful, and prudent. The same habits, indulgences, and discretions that are found among those in possession of their natural limbs are found in about the same proportion among those who have been amputated.

Gratitude.—It is also an error to suppose that the loss of a limb induces despondency. There will not be found a class of people who are less lugubrious and who lament their losses as little as that class of humanity having abbreviated extremities. We recall the visit of a man some years ago who had both of his legs and one arm amputated. After reciting a harrowing tale of a railroad collision and fire, weeks of suffering at the hospital, and his recovery to health with only one of his four limbs remaining, he closed his narrative with the ejaculation: "Thank God, it was no worse!" This illustrates fairly well a crippled man's disposition. He is more thankful that he has not lost more, than he is regretful for having lost so much. He is constantly meeting with persons who, in his mind, have met with greater hardships than himself. It is an ordinary occurrence for a one-legged man to meet a one-armed man, and for each to say to the other, "I prefer to be as I am rather than as you are."

A cripple is neither a cynic nor a pessimist. His misfortunes have driven from him whatever there may have been of the choleric. Being always in good health, he is a happier and a more contented man than the dyspeptic, the rheumatic, or the gouty man, who is in possession of all his limbs. It is a common occurrence for a man wearing two rubber feet to take consolation from the fact that he can never be troubled with corns, gout, or suffer the torture of having some ponderous lout tread on his feet.

Nature, with her usual generosity, compensates for every misfortune. We look about us and see conditions that are appalling, and are impelled to pour out our commiseration; but we little think how useless, how unsolicited, and often uncharitable it is for us to do so. Those that are the most afflicted need our commiseration the least. Their minds and dispositions have already been prepared by Nature to bear their misfortunes, and they dislike to have others notice or mention them, much less to shed tears over that which they so little regret themselves.

CHAPTER XXXV

AWARDS

1858. The first Exposition at which A. A. Marks exhibited artificial limbs was at the Crystal Palace at New York in 1858. As that exhibition was destroyed by fire no awards were given.

1859. American Institute, New York City.—The silver medal was awarded to A. A. Marks for his superior artificial limbs.

1865. American Institute, New York.—After a careful and extended examination, and practical tests of the various kinds of artificial limbs, the First Premium Gold Medal was awarded to A. A. Marks.

1867. American Institute, New York, First Premium.—Marks' Patent Artificial Limbs have frequently been before the Institute and continue to sustain their former reputation. The First Premium awarded.

1869. American Institute, New York.—A. A. Marks Best. This limb is constructed with an india-rubber foot, which from its elasticity does away with the necessity of motion at the ankle, and also obviates entirely that heavy, thumping sound when the foot strikes the ground in walking. The control which the wearer has over it and its movements, so closely resembling those of the natural limb, entitles it to the highest commendation. First Premium awarded.

1870. American Institute, New York.—The especial point of excellence appears to be the rubber foot, by the use of which all complications in the construction of an ankle joint are avoided. First Premium awarded.

1871. American Institute, New York.—The artificial limbs with rubber feet and rubber hands are especially recommended for their simplicity, durability, and easy movements. First Premium awarded.

1872. American Institute, New York.—The artificial limbs manufactured by A. A. Marks continue to merit approval, and are entitled to all the confidence the public have reposed in them. First Premium awarded.

1873. American Institute, New York.—After full and impartial examination of the articles above described, the undersigned Judges make report that they find the artificial limbs on exhibition by A. A. Marks worthy of the confidence heretofore reposed in them. We cheerfully indorse all that has been said of them by former examiners, *their simple construction, easy movements, durability, etc.* First Premium awarded.

1874. American Institute, New York.—We consider the artificial limbs of A. A. Marks of great value. A great improvement

—better than any known to us; and entitled to the highest award. First Premium awarded.

1875. American Institute, New York.—We regard the artificial limbs presented by Mr. Marks superior to all others in practical efficiency and simplicity. First Premium awarded.

1876. Centennial Exhibition, Philadelphia, Pa.—The Judges having examined Marks' artificial limbs respectfully recommend the same to the United States Centennial Commission for the highest award, for the following reasons, viz: Utility, Workmanship, and Adaptation to Purposes Intended. Highest award given.

1876. American Institute, New York.—The judges consider the limbs made by A. A. Marks remarkable for simplicity of construction, durability, efficiency, and comfort to the wearers. Special Gold Medal awarded.

1877. American Institute, New York.—After a full and impartial examination of Marks' artificial limbs, the Judges report that they consider the exhibit of great value and entitled to highest award. Medal for Superiority awarded.

1878. American Institute, New York.—Having received the Medal of Superiority in 1877, The Diploma for Maintained Superiority is awarded at the Exhibition of 1878.

1881. International Cotton Exposition, Atlanta, Ga.—First Premium, Gold Medal, awarded for the following reasons:

First. Simplicity in the mechanism of the knee joint and its excellent movement. Second. Durability. Third. Rubber Foot, possessing many excellent qualities and compensating for the absence of the motion in the ankle joint. The highest award was declared in favor of A. A. Marks.

1885. The World's Industrial and Cotton Centennial Exhibition, New Orleans, La.—The Jurors having carefully examined the exhibits of artificial limbs concur in recommending the award of the First Class Medal to A. A. Marks, New York. Gold Medal awarded.

1889. The John Scott Legacy Premium and Medal.—John Scott, late of Edinburgh, by his will made in the year 1816, bequeathed a sum of money to the Corporation of the City of Philadelphia, directing that the interest and dividends received therefrom shall be laid out in premiums, to be distributed among ingenious men and women who make useful inventions, and that therewith shall be given a medal with this inscription:

"To The Most Deserving."

The great improvements in artificial limb construction consist in the substitution of rubber for wood in both the foot and hand.

The rubber foot consists of a wooden block rigidly secured or formed with the leg and extending downwardly to within about two-fifths of the distance from the ankle to the sole, and forward to nearly the first articulation of the metatarsus and toes; this block is covered with india-rubber.

The action of such an artificial foot is that of an elastic segment

of a wheel. The shock of placing the weight upon the heel at each step is avoided by the elastic cushion of rubber forming the heel, and as the weight is progressively transmitted to the forward part of the foot, by the combined effect of muscular exertion in the remaining part of the natural limb, and the momentum previously acquired, an easy flexure of the toes takes place, which, reacting elastically as the weight is transferred to the other limb, giving an easy and naturally appearing movement. Such artificial feet are, upon trial, found to be easier to use, lighter, and more comfortable.

The desire to adapt the india-rubber hands to changes of flexure, for purposes of better and more natural appearance and to grasp light objects, led Mr. Marks to improve them by making a light wooden core in the palm or metacarpal portion of the hand and inserting ductile metallic wires in such core, which extended centrally through the fingers. By bending the fingers they retain the form in which they are set.

The latest improvement in artificial limbs consists in forming the leg and foot part of a single piece of wood, having the grain curved naturally in its growth, such pieces being procured from the parts of the trunk contiguous to the roots and branches of trees; limbs made in this way are stronger with the same amount of wood remaining in them than when made of parts glued together, and are made waterproof, which is a valuable feature when the occupation of the wearer exposes it to constant dampness, or to water itself, as in fishing, mining, dredging, etc.

The above report was presented to the committee appointed by the City of Philadelphia, under the auspices of the Franklin Institute, and it was unanimously decided that the John Scott Legacy Medal and Premium be awarded to A. A. Marks.

1891. Augusta Exposition, Augusta, Ga.—Seven Gold Medals and Awards for distinct and separate features of excellence.

First. For Improved Artificial Legs with Rubber Feet.

Second. For Improved Artificial Arms with Rubber Hands.

Third. For Superior Methods of Suspenders for Artificial Legs and Arms.

Fourth. For Superior Crutches and other Auxiliaries for Cripples.

Fifth. For a Combined Knife and Fork for the use of one-armed men.

Sixth. For Improved Waterproof Artificial Legs, carved from natural crook timber.

Seventh. For Improved Artificial Legs and Arms with Aluminum Sockets.

1893. The Elliott Cressons Gold Medal, awarded to A. A. Marks for aluminum socket artificial legs and arms, as stated in the following report:

At the stated meeting of the committee on Science and the Arts of the Franklin Institute, held February 1, 1893, the following report was adopted and ordered to be issued:

This invention consists of an improved method of making arti-

ficial limbs, adapted to amputations in the ankle, or below, in the tarsus or metatarsus, in which the former modes of construction, with articulated ankle joints of wood as the material, were impracticable and unsatisfactory. The new method of construction involves the use of aluminum as the material to form the shell socket or sustaining frame, as it might be called, the aluminum shell supporting the body, and forming the attachment for the elastic rubber foot, which acts as a rolling elastic segment simulating the functions of the natural foot in walking, and acting as an elastic cushion in relieving the wearer from the jar or shock of resting the weight upon the limb.

Your committee has examined the limbs in the course of manufacture, and as completed and as in use by wearers. When clothed, they give no indication in walking that they are not natural feet.

It is clearly apparent that the invention is one affording much-needed relief to persons heretofore greatly embarrassed, and further that the surgeons may save much more of the patient's body from mutilation than heretofore, and yet render comfortable and satisfactory artificial limbs practicable.

In view of these points of excellence and well-attested evidence thereof the committee awards the Elliott Cresson Medal to Mr. Marks, of New York.

1893. World's Columbian Exposition, Chicago.—The judges appointed to investigate artificial limbs decided in favor of Marks' artificial limbs and recommended to highest award on the following points of excellence.

First. Rubber Foot. (*a*) Its close approximation to the motions and actions of the natural foot.

(*b*) Its durability and lightness; the yielding and elastic qualities of rubber supply requisite motion without necessitating mechanism.

(*c*) Phalangeal assistance. The methods of construction and connection with the body of the leg in each case are such as to provide assistance in walking from the anterior portion of the foot, at the same time maintaining the height of the wearer when walking, same as is obtained from the natural foot; the feature of phalangeal assistance avoids limping, and removes the fear of toppling forward when standing.

(*d*) The elasticity of rubber affords a yielding medium to alight upon, thus avoiding jars and concussions to the stumps.

Second.—Knee Joints. (*a*) The construction of knee joints is such as to render them capable of adjustment, thus obviating the noise that follows attrition.

(*b*) The disposition of the knee spring, which assists extension of the lower leg, is such as to become neutralized when the leg is flexed to a given angle; this avoids "kicking out" of the lower leg when the wearer is sitting and unguarded.

(*c*) Safety lock. This attachment is combined with the knee mechanism, and provides against treacherous flexing of the knee, thus avoiding dangerous falls.

Third. The production of waterproof legs from natural crook timber with rubber feet attached.

Fourth. Aluminum sockets, especially designed for stumps that extend to the ankle and in the body of foot.

The advantages obtained by the utilization of this metal are as follows:

(*a*) The production of a socket that can be closely fitted to the stump, without touching or allowing painful contact with any of the tender spots on the stump, at the same time possessing sufficient strength to properly support the wearer.

(*b*) The construction of a socket that will possess the requisite strength without conspicuously enlarging the ankle.

Fifth. Roller Suspenders. The object of this method of suspending an artificial leg to the wearer is to avoid the moving and rubbing of the shoulder straps on the shoulders.

First. The Rubber Hand. (*a*) Being composed of rubber, is pleasant and natural to the touch and durable in construction.

(*b*) The fingers, being ductile, can be placed into accommodating positions.

(*c*) The palm of the hand, being provided with a locking socket, is capable of holding implements of utility with firmness.

Second. The ability to detach the hand at the wrist for laboring purposes.

Third. Rotation of hand at wrist.

Fourth. The elbow joint, with lock for holding the arm in a flexed position.

Fifth. Fingers and parts of hands made of rubber.

Sixth. Rotation of upper arm socket.

In conformity with the Judges' report, the highest award (medal and diploma) was declared in favor of A. A. Marks, New York City.

Two additional diplomas were awarded by the Board of Lady Managers, one for Design, and the other for Invention.

1895. Cotton States and International Exposition, Atlanta, Ga.—This certifies that the appropriate jury has awarded to A. A. Marks of New York City the Gold Medal "For the most complete exhibition of ingenious mechanics for the relief of physical defects and deformities, namely: Artificial Legs, Rubber Feet, Artificial Knee Joints, Self-Adjusting Suspenders, Artificial Arms, Rubber Hands, Duplex Elbow Joints, and Aluminum Socket Legs; also for Imitating the Movements of Knee, Elbow, Wrist, and Finger Joints."

1896. American Institute, New York.—After a full and impartial examination the Judges made report:

That the exhibit of A. A. Marks of artificial limbs, deserves the highest award for the following reasons.

First. To the rubber foot with imbedded metallic mattress spring.

Second. To the flexible fingers on artificial hand, and their great adaptability to everyday use.

Third. The use of aluminum in place of wood for climatic varia-

tions seems to be of practical use for those engaged in certain employments.

Finally, the ingenious combination Knife and Fork for the one-armed is highly commended. The medal of superiority was accordingly awarded.

1897. Tennessee Centennial and International Exposition, Nashville, Tenn.

The highest and only award for artificial limbs was given to A. A. Marks of New York.

The merits that received especial recognition were: Artificial Legs with Rubber Feet, Adjustable Knee Joints, Artificial Arms with Rubber Hands, and a Combination Knife and Fork for one-armed persons.

1898. Trans-Mississippi and International Exposition, Omaha, Neb. Diploma and Gold Medal awarded to A. A. Marks, New York.

Marks' Artificial Legs with Rubber Feet and Artificial Arms with Rubber Hands are superior to all others in the following points:

Excellence of mechanical construction.

Minimum weight, maximum durability.

Noiselessness.

Motions that simulate nature.

Knee joints, adjustable and noiseless.

Suspenders, of variety adaptable to every condition.

Knee lock for short and enervated stumps.

Fittings that permit pressure at points of toleration; avoiding impact on the vascular parts, thereby preventing choking of blood vessels.

Rubber hands with ductile fingers, most accommodating and possessing the greatest range of utility.

1900. Exposition Universelle de Paris, France.

A. A. Marks, New York.

Dear Sir:—I am instructed by Commissioner General Peck to inform you that you have been awarded the

(GRAND PRIX) Grand Prize

for your exhibit in Class 16 at the International Exposition, Paris, 1900.

Respectfully yours,

J. H. Gore, Juror-in-Chief.

In competition with nearly fifty manufacturers from all parts of the world, A. A. Marks won over 20 POINTS OF MERIT, thereby earning the ONLY GRAND PRIZE FOR ARTIFICIAL LIMBS.

1901. Pan-American Exposition, Buffalo, N. Y. The points of merit and claims for superiority presented to the Board of Jurors, as follows:

First. The rubber foot with spring mattress.

Second. Knee joint with adjustable bearings and removable bushings.

Third. Hip joint for hip-joint amputations.

Fourth. Knee lock for short and enervated stumps.

Fifth. Suspenders arranged to minimize the burden and tax on the shoulders.

Sixth. Aluminum sockets for ankle-joint and partial foot amputations.

Seventh. Rubber hand with ductile fingers and palm attachment for holding implements.

Eighth. Wrist joint admitting of rotation, displacement of the hand and substitution of laboring implements.

Ninth. Elbow lock, holding arm in flexed and other positions.

Tenth. Humeral rotation, admitting the arm to rotate above the elbow joint, so that when flexed it can be brought closer to the person.

Eleventh. Artificial hand for partial hand amputation.

Twelfth. Artificial legs for bathing purposes.

Thirteenth. Artificial arms that are absolutely waterproof.

Fourteenth. Combination knife and fork designed for persons who are temporarily or permanently disabled in one hand.

Upon these points of merit the Gold Medal and Diploma were awarded to A. A. Marks.

1902. South Carolina Inter-State and West Indian Exposition, Charleston, S. C. Gold Medal awarded to A. A. Marks, of New York, for artificial legs and arms of superior construction.

1904. The Louisiana Purchase Exposition (World's Fair), St. Louis, awarded to A. A. Marks, of New York, the only GRAND PRIZE for ARTIFICIAL LIMBS, the highest award given to any exhibit in any department.

The Grand Prize at St. Louis following the Grand Prix at Paris. 1900, prove beyond controversy the superiority of Marks' artificial legs, feet, arms, and hands, and the maintenance of their excellence not only in America, but throughout the entire world.

1905. The Lewis and Clark Centennial Exposition, Portland, Oregon, awarded two Gold Medals (highest awards) to A. A. Marks, New York, manufacturers of the celebrated artificial limbs with rubber feet and hands.

1907. New Zealand International Exhibition, Christchurch, New Zealand, November, 1906, to April, 1907. The highest award of merit, Gold Medal, to A. A. Marks, New York, U. S. A., Artificial Limbs.

1907. Jamestown Exposition, Norfolk, Va., April 26th to November 30th. The highest award Gold Medal to A. A. Marks, Artificial Limbs, New York.

1914. Auckland Exhibition, Auckland, New Zealand—First and Special Diploma and Gold Medal to A. A. Marks, New York, Artificial Limbs.

1915. PANAMA-PACIFIC INTERNATIONAL EXPOSITION, San Francisco, California—Highest Award to A. A. Marks, New York, Artificial limbs with rubber hands and feet.

CHAPTER XXXVI

TESTIMONIALS

It would not be an exaggeration to say that we receive annually over a thousand letters bearing testimony of the excellent qualities of our products. To print these letters would mean a publication of huge proportions and so prolix as to be wearisome.

We have, heretofore, printed and illustrated extracts from testimonials, adding thereby many pages to our manual. But we are now departing from that method, and are listing the writers in a way that the readers can select men or women whose occupations, ages and peculiarities of amputations may interest them mostly. This arrangement not only economizes space but makes it possible for the reader to select cases that are like his own. It also proves the many contentions that are claimed for the superior quality of our artificial limbs.

The reader can select as many names as he chooses and send them to us. We will immediately furnish the most recent addresses we have. This will enable the reader to call upon or communicate with whomever he wishes.

Persons wearing artificial limbs move about the same as those in possession of their natural extremities. They change their addresses and fail to inform us and sometimes fail to inform their own post-offices, therefore letters are returned with stamp, "Moved to Parts Unknown." The reader must not be disappointed if his inquiry meets with the same fate. We are powerless to correct it.

Sincerely yours,
A. A. MARKS.

CHAPTER XXXVII

CONTENTIONS

1st Contention

MARKS ARTIFICIAL LEGS AND ARMS ARE SUPERIOR:

Robert Haak writes the "Marks Leg is the best he ever wore"; he had worn many other makes. Dr. C. J. Hamilton writes: "There is no other firm that gives such successful results as you do." Edward Harris writes that the two other legs he had worn were a waste of money, "Marks Leg the best" Archer R. Johns, also John Peters and many others write that as an experiment they had the wooden feet of their old artificial legs removed and rubber ones put on, eliminating ankle motions, and were benefited by the substitution. Dr. C. S. Judy writes that "Marks Leg is the best because it is simple in its construction and in its adjustments." F. M. Kelleher wore a Marks Leg, then tried a slip socket, was disappointed and returned to the Marks, which he has worn since. John T. Rice states that with all other artificial limbs he had worn, he suffered from chafed and irritated stump, the Marks Leg gave him relief, not so much on account of better fitting, but the fact that the rubber foot avoided jar in walking, which he always felt with the wooden foot. J. F. Baldridge wore two Marks Legs, then got one with wooden foot, finds the Marks the best. E. George Moses writes that the leather sockets of other make artificial limbs caused irritation to his stump, but the firm willow socket of the Marks Leg being smooth, did not allow friction, therefore his stump was not irritated and he wears the Marks Leg with more comfort. J. G. McIntyre writes that he earns more wages with the Marks Rubber Foot Leg than he did before he got one. Abelardo Lopez of South America writes that the Marks Leg is light and strong, therefore better than any other he had worn. M. C. Gallo writes that the fingers of the wooden hand he had formerly used were always breaking, but that the fingers of the Marks Rubber Hand never broke.

It may interest the reader to find so many commenting on the advantages of the rubber foot without ankle motion in propelling bicycles.

A. M. Caldwell, Rev. J. H. Kent, Theo. M. Keough, C. B. Kingsley, A. F. McNaughton, J. R. Malcolm, H. E. Martin, C. B. Metcalf, A. E. Oakes, Luis Restrepo, John T. Rice, Gabriel Perez Rivero, Mrs. B. J. Shurtleff, Joseph Smith, E. W. Spedding, H. C. Temple, Charles Wilkin.

2nd Contention

MARKS ARTIFICIAL LEGS AND ARMS ARE DURABLE AND STAND THE HARDEST AND LONGEST SERVICE:

It is interesting to know how many have worn Marks Artificial Legs and Arms for scores of years and speak of their durability and efficiency for long, continuous service. Some of the statements are hardly credible, but investigations prove their truthfulness.

The simplicity with which the Marks Artificial Legs and Arms are constructed makes it possible for them to last a lifetime, even if the wearer reaches advanced years. There is practically nothing to get out of order and when worn by persons of mechanical minds the at-

tentions that may be needed from time to time are given by the wearers themselves.

Mrs. William J. Bryan writes what little repairs her husband's artificial leg, which he has worn continuously for 14 years, has required, he has always made them himself. Many similar letters can be found in the list.

We give below a list of writers who are among our oldest living patrons. Those who wish to be assured of the durability of our limbs will find much to think over in their letters. This list contains only those who have worn Marks Limbs for over twenty years. There are nearly one hundred other letter writers who have worn them from ten to twenty years. A considerable number state they have only worn *one* artificial limb during the period mentioned, a few state that they have had renewals.

William Griffin writes he has worn Marks Limb for 51 years, John Matthews for 50 years, Dr. R. T. Taggart 48 years, J. G. Shirk 46 years, D. M. Green 45 years, Henry F. Hicks 45 years, George F. Morse 45 years, E. A. Gallup 43 years, Silas W. Fickel 40 years, M. Parrage 40 years, E. O. Rentz 40 years, Edw. E. Bownes 39 years, John H. Valentine 39 years. Jose Baquero writes: "The leg you sent me 38 years ago is being worn yet." A. W. Mills 38 years, Isaac Post 38 years. Dr. E. P. Rice states his father has worn a Marks Leg for 38 years, Jose Estevez 34 years, J. J. Booth 33 years, W. J. Bray 33 years, Dr. C. E. Smith 33 years, George Hy. Barstow 32 years, George Martin has worn a Marks Arm 29 years, W. H. Roberts, leg 32 years, Hugh Thompson 31 years, H. Van Ormondt 31 years, W. L. Agnew 30 years, S. T. Criss 30 years, John B. Lawrence 30 years, Enos Lincoln 30 years, Antonio Alarcon 29 years, Uriah Bursey 29 years, O. S. Chapman 29 years. John Nicol has used a Marks Arm for 29 years, H. W. Posz, leg 29 years, J. W. P. 29 years, James W. Cullins 28 years, T. C. Fowler (arm) 28 years, R. D. Rodgers (leg) 28 years, Rev. G. W. Brownback 27 years, W. A. Clark, M. D., 27 years, James O. Kellum 27 years, W. O. Miller (arm) 27 years, George W. Shipper (leg) 27 years, J. M. Willard 27 years, Edward J. Gallagher 26 years, Rev. J. W. Knappenberger 26 years, Wolf Lorenzen 26 years, James A. Murta 26 years, Peter Anderson writes: "I am still wearing the same leg I got from you in 1891, I have never left it off a day on account of sore stump."

A. B. Boren 25 years, W. L. Caldwell 25 years, David M. H. Deupree 25 years, George W. Hart 25 years, A. A. Jack 25 years, W. G. M. 25 years and has put it to the hardest kind of use. J. R. Malcolm 25 years, R. W. Powell 25 years, Edwin D. Smith 25 years, Joseph Smith 25 years, M. B. Wells 25 years, C. E. Caney 24 years, Charles A. Christie 24 years, C. C. Crane 24 years, Alf. De Root 24 years, George C. Hobbs 24 years, Hans Jacobson 24 years, Jos. S. Poirier 24 years, S. A. Benton 23 years, W. J. Kraft 23 years, A. E. MacArthur 23 years, A. E. Magoffin 23 years, William E. Nelson 23 years, Hugh Pike 23 years, James Tobin 23 years, John B. Young 23 years, A. J. Zabriskie 23 years, James Burton 22 years, Oscar Coins 22 years, J. A. Jarratt 22 years, S. W. Jones 22 years, F. M. Kelleher 22 years, W. L. Kuhn 22 years, A. L. Naylor 22 years, John Newstubb 22 years, John A. Nilson 22 years, Stephen Norman 22 years, C. D. Preston 22 years, W. T. Walker 22 years, Michael Aurich 21 years, Peter Champagne 21 years, James A. Crandall 21 years, Alfred Crewe 21 years, Robert T. Davidson, M. D., 21 years, Albert Maiden 21 years, T. H. Morgan 21 years, J. H. Steele 21 years, Miss Mary A. Cummings 20 years, H. A. Jones 20 years, Ralph E. Lock 20 years, Duncan McRae 20 years, C. H. Wolfe 20 years and thousands of others who have not written or mentioned the years of patronage in their letters.

3rd Contention

CONSTRUCTING AND FITTING ARTIFICIAL LIMBS BY MEASUREMENTS SUCCESSFUL, ECONOMICAL AND CONVENIENT:

Seventy-four out of every hundred of testimonial writers obtained their artificial limbs by sending their measurements and having them constructed by them. The measurements were taken by their doctors in some cases, by mechanics familiar with measuring in others and very frequently by themselves with the assistance of some member of the family or a friend. This is very frequently done when women order for themselves.

The process of taking measurements is very simple. It is fully illustrated and described on measuring sheets we supply. The system has been so thoroughly worked out that there is hardly a possibility of an error. Disappointments are extremely rare. By this system it is possible for a man living thousands of miles away to get a Marks Limb at the published price and be spared the inconvenience, loss of time and expense of traveling to New York. Far better for him to be measured at home and obtain the best, than to entrust his case to a locksmith, machinist, woodworker, shoemaker, or what not, located near him who has seen fit to establish himself as an artificial limb maker and puts out the argument that it is better to be fitted personally by a maker of little experience than be fitted by measurements by an expert.

The making and fitting of artificial limbs is full of problems. Many years of experience and practice, many years of careful study are required to equip a man to do the work properly. The anatomy of the stump, the circulation of the blood, the location and functions of glands are the same in all and should be understood by the fitter, otherwise grave consequences may result. It is far better to order a limb by mail and send measurements for its construction and have it scientifically fitted, than to entrust the work to a nearby mechanic who has not this knowledge and experience.

Margaret M. Allison writes that she went to the city of Edinburgh and had a leg made and fitted to her personally, but the Marks Leg she got from measurements was much more comfortable.

Sarah Fieldhouse writes that she had to take her old leg off several times during the day to relieve her stump, although the leg was fitted to person by a local maker, but when she got a Marks Leg fitted by measurements, she had comfort all the time and never took the leg off except on retiring.

Judge D. C. Hawk of Kansas had worn a number of legs fitted to him personally, but the Marks made from measurements in 1913 gives him much better satisfaction.

William S. Jones, living in Luzerne Co., Pa. (not very far from New York), has his limbs made by Marks, fitted by measurements, prefers to do so than to be subjected to the expense and loss of time of even a short trip. He says: "Personal fittings are entirely unnecessary."

Jose Maria Jorge got a leg in Sao Paulo, Brazil, made and fitted to person; he could not wear it with comfort. Upon getting a Marks Leg fitted from measurements he wrote: "The leg is light and fits comfortably."

John Madden writes regarding the leg he obtained from Marks that he could not have gotten a better fit if he had come to our factory.

M. E. Martin of India went to England, got a leather socket fitted to person, had several, none of them fitted, they tortured him, but

the Marks Leg made and fitted by measurements was comfortable and far superior in every way.

Francisco Silva of Central America tried a leg made by a local manufacturer; it proved to be a failure, but the Marks Leg was a success.

Further evidences regarding the efficiency of fitting from measurements are obtainable from Matias Ahumeda, Peter Anderson, W. C. Bliss, M. D. Silas W. Fickle, Bessie French, P. H. Garside, David Gluck, David Grant, George C. Hobbs, Robert Jackson, James Jeffrey, F. M. Kelleher, C. B. Kingsley, C. L. McClure A. F. McNaughton, E. George Moses, A. E. Oakes, George W. Oman, J. G. Shirk and others.

4th Contention

MARKS ARTIFICIAL LEGS AND ARMS THE MOST SUITABLE FOR ALL OCCUPATIONS:

The occupations of testimonial writers are given in nearly every case. These pursuits were followed while wearing Marks Artificial Legs and Arms with Rubber Feet and Hands. Men or women who do things, who are engaged in actual pursuits of life, present the strongest proof and are the best guides. Nearly every occupation from the Deepsea Fisherman of Newfoundland to the Canal Diggers of Panama, from the woman housekeeper to the woman dressmaker; labors requiring firm, sound and dependable footing as well as those subjecting limbs to severe tasks are here represented.

In looking over the list we note that Sam Berry marches with band and beats a drum, amputation below knee. Louis Fournier, who wears a pair of Marks Artificial Legs, drives an automobile many hours every day and experiences no difficulties in operating the foot pedals. Mr. W. Hymison dances on a rubber foot so perfectly that no one suspects that one of his legs is artificial. Mr. John J. Kelly works on a swinging scaffold painting signs on lofty buildings. Mr. E. J. Oliver does the same, but he wears a Rubber Hand. Mr. C. F. Read with a Marks Foot pushes and pulls a hand truck loaded with a case weighing 1,000 pounds. Mr. W. L. Smith plays pools with a Rubber Hand.

It is indeed interesting to read what these wearers of artificial limbs do, showing beyond a doubt that the loss of one or even a pair of limbs, or the loss of an arm does not deprive a person of his ability to return to his preferred occupation, and earn his livelihood.

More women writing these testimonials are occupied with household work than any other occupation. Farming life among men seems to predominate, though wearing artificial legs and arms they do not permit the grass to grow under their feet.

The pursuits of the writers of those letters may be classified as follows:

Accountant: J. V. Julian, G. D. Salway.
Advertising Agent: W. L. Agnew.
Aeronaut: F. E. Jacoby.
Artificial Limb Representative: George Hy. Barstow, Antonio M. Geoffroy
Artist: Jos. E. Keefe.
Auditor: A. C. O'Neil, William E. C. Heyms.
Auto Tire Manufacturer: J. Underwood.
Automobile Agent: Henry W. Booth.
Automobile Driver: Dr. J. B. Aycrigg (hand), Edw. F. Beach (arm), Hy. W. Booth, M. C. Gallo, Ray W. Holden, Alfred H. Knapp, V. R. May, Charles G. McCleary, C. L. McClure, James H. Smoot, H. F. Watson.

Baggageman: C. Bolduc, John L. Thomas.
Baker: William Darragh, G. H. Kennedy, both legs. George A. McMahon, both legs amputated. E. M. Spedding, A. F. Sykes, both legs.
Banker: Keith Edwards, Leslie Langill.
Barber: D. O. Greene, Albert Maiden, Edw. McGonigal.
Bayman: Alden Biggs.
Bench Hand: James F. Callahan.
Bicycle Dealer: R. A. Williams.
Bird Dealer: P. S. Berges, John Dunn.
Blacksmith: George Baldwin, John Dunn, T. F. Forster, Armitage Gothergill, J. A. Jarratt, J. G. McIntyre, A. F. McNaughton.
Boatman: Alfred De Root.
Booking Clerk: E. A. Oates.
Bookkeeper: J. A. Arrighi, Carl Boysen, W. C. Corley, C. W. Couch, S. T. Criss, Hy. H. Daigle, Edward J. Gallagher, William E. C. Heym, H. A. Jones, Duncan McRae, E. E. Roberts, G. S. Salway.
Bootblack: Harry V. T. Williams.
Bottler: Charles Deifel.
Bowling Alley Keeper: James Lahive.
Broker: S. A. Benton.
Builder: M. C. Gallo, G. D. Kerns, R. Thorpe.
Cabinet Maker: Flavio Capricci, Ernest Robinson, C. H. Wolfe.
Canning Factory: Harry Robbins.
Canvasser: J. B. Bissonette, C. S. Michael.
Carpenter: J. F. Baldridge, Charles Barrett, Bruno Bernier, H. T. Drake, Ramiro Gomez, D. M. Hillyard, I. J. Marks, M. C. Marshall, C. W. Nicholson, R. Thorpe, C. H. Wolfe.
Carter: Eccles Crawford, John Gordine.
Car Window Cleaner: B. J. Horton.
Cashier: C. L. Lewis, R. W. Powell.
Cement Laborer: Charles Tyrrell.
Cemetery Work: James Baxter.
Chauffeur: Louis Fournier, Clyde L. McClure, R. H. Malson, Albert Moreau, Mario Pillich y Colon, Richard T. Piper.
Chemists: See druggists.
Chiropodist: Dr. D. H. Ricker.
Cigar Manufacturer: Jose Estevez, W. L. Kuhn.
Civil Engineer: Jonas E. Hesselman, Edw. C. Terry.
Clams: Alden Biggs, A. W. Mills.
Clergyman: Rev. G. W. Brownback, Rev. Oscar Gesner, Rev. E. W. Hawthorne, Rev. J. H. Kent, Rev. J. W. Knappenberger, Rev. Robert E. Pogue, Rev. J. W. Potter, Rev. Charles M. Reed, Rev. Charles B. Veillet.
Clerk: William J. Bray, R. V. T. Buck, Arthur Caffrey, Charles Cerriter, W. C. Corley, James A. Crandall, Frank Durn, H. L. Farr, William Griffin, Robert D. Hamilton, W. E. Harrison, H. J. Holden, Roy Holt, James Jeffrey, S. M. Lehigh, George Lomas, Abelardo Lopez, Thomas H. Lygo, John Marshall, Felipe Montes de Oca, James W. Moore, James A. Murta, A. E. Oakes, L. Palmer, Luis Restrepe M., Walter Swanson, P. C. Thomas, Jos. J. Tuscamo, Miss Flora A. Thompson, W. T. Walker, L. C. Watson, A. W. Weaver, J. Webster.
Coachman: Andrew C. Apgar.
Coal and Feed Dealer: Isaac Post.
Collector: Edw. Harris, Wilson Jones, T. C. Fowler, George G. Twitchell.

Commission Agent: W. M. Scandrett.
Concrete Worker: C. A. Brown.
Confectioner: Ewart W. Spedding, Albert F. Sykes (both legs).
Contractor: M. C. Gallo, Thomas Killgour.
Cook: Miss Minnie Osborne, H. A. Sutherland.
Cotton Picker: D. W. Knowles.
Cowboy: John W. Kent, E. P. Low.
Customs Officer: A. J. J. Austin, M. D., A. Cantu, John Madden.
Dancing Instructor: John Burkley.
Delicatessen Store: George W. Steinmetz.
Dentist: B. W. Makkink, F. H. Paul, R. F. Taggart.
Die Maker: John H. Valentine.
Dispatcher: W. H. Roberts.
Draper: Harvey Gregson, Miss F. Jones, Miss N. Gostelow.
Draughtsman: Edgar Broadley, David Grant, O. S. Chapman.
Dressmaker: Miss R. E. B., Miss Adelaide Moody.
Driver: Charles E. Chamberlain, H. J. Holden, J. J. Veal, John Vogel.
Druggist: R. S. Cussans, A. E. Magoffin, Virgil R. May, A. W. Weaver.
Editor: Antonio M. Geoffroy.
Electrician: Jose Ortiz J.
Engineer: R. C. Evans, William W. Grant, J. E. Hesselman, J. A. McDonald, William McGettigan, John Nicol, A. T. Peterson, Benjamin V. Smith, Edw. C. Terry, John Vial.
Evangelist: Miss Louise B. Albach.
Expressman: Frank Triacca (both legs amputated).
Farmer: William Allison, Joel Avant, James Baxter, Hosea Beach, Adolph Bernauer, William G. Bierce, Harry Brooke, Ed. Boerner, A. B. Boren, J. F. Brewer, M. D., Thomas P. Brown, Andrew Bush, Euclid Cardinal, Russell Carmichael, J. D. Cluck, George Coleman, George Davis, J. C. Dawkins, A. S. Dennis, M. D. Dowell, Keith Edwards, Manuel Espinosa, John Fender, Silas W. Fickel, R. G. Floyd, M. D., Fred E. Gardiner, George A. Garland, James D. Gold, M. D., Raymond Grimmer, H. A. Haine, George W. Hart, Ray W. Holden, Jason House, Hans Jacobson, C. Jent (arm), James O. Kellum, August Kohrman, Carl Larson, J. P. Lee, M. M. Loomis, Wulf Lorenzen, Jack Lyles, W. G. M., H. E. Martin, R. H. McKinnon, I. J. Marks, C. B. Metcalf, Otto Meyer, W. O. Miller, Jacob Mumm, John Murray, Patrick Nolan, G. W. Oman, Christian Opp, Mr. Patrick, A. T. Peterson, A. S. Porter, M. D., J. A. Quigley, W. L. Ramsey, M. A. L. Richardson, Harry Robbins, William Robinson, Lloyd Saylors, George Shafer, J. H. Sharrock, J. G. Shirk, Francisco Silva, John M. Smith, James H. Smoot, Jos. H. Steell, George G. Twitchell, Jos. M. Underwood, H. D. Unganst, Dolphus Villneff, George Wanamaker, J. B. Wessels, J. H. Willard, S. A. Wing, Sam Wood, H. Wright, C. A. Zellner.
Fireman: Henry Erb, F. Foust, W. W. Grant, Martin Judge, C. E. Prather, R. D. Rogers, Henry W. Smith, Isaac Winfrey, Alpheus Wright.
Fish Dealer: Hy. F. Hicks (both legs).
Fisherman: Charles Barrett, Olai Bertelsen, Henry Blake, Archy Bungy, Uriah Bursey, L. H. Crowley, Thomas Giles, Alfred King, C. Legge, John McKays, John E. Musson, Patrick Nolan, Alex. Noseworthy, John Sheahan.
Fish Hatcher: Fred E. Gardiner.
Foreman: Maxime Cyr, P. J. McCarthy, T. C. Rains, A. Wright.
Foundry Worker: F. R. Mobray, Wilfred Vanden,

Fruit Grower: A. M. Caldwell, Frank I. Mason.
Gardener: Martin Baal, Harry J Breach, Peter Griffin, A. H. Knapp, M. J. Lowe.
Governess: Miss Amy Campbell.
Gravel Pit: H. Rosanowski.
Grocer: A. J. Eckles, A. Loup, C. D. Preston, Edwin Walker.
Harness Maker: Samuel Abrahams.
Hay and Feed: John Scharff, George Shafer.
Horse Dealer: W. A. Griffin.
Horse Shoer: A. F. McNaughton, Enos Lincoln.
Hosiery: Charles E. Welsh.
Hostler: Selah L. Smith.
Housework: Mrs. Walter Abel, Miss M. M. Allison, Mrs. A. Armitage, Miss Alice E. Bacon, Miss N. A. Bailey, Mrs. L. E. Bixler, Miss Ella Buerger, Mrs. F. Cardinal (both legs), Mrs. Grace Carsley, Miss Lena Dagenhart, Miss A. J. Dockendorff, Mrs. H. B. Edens, Mrs. Robert Edgar, Mrs. Sarah Fieldhouse, Miss Bessie French, Mrs. Marie Frene, Mrs. Lilly A. Gibson, Mrs. Mary Grant, Mrs. Karoline Harmon, Mrs. H. Harvey, Drs. Hutchinson and Peebler, Mrs. Arthur B. Joseph, Mrs. Edna Lawrence, Mrs. Regina Mehl, Mrs. E. Murgatroyd, Miss Lillie Noethlich, Mrs. Lula Oldham, Mrs. C. Quinn, Miss Fanny F. Reed, Mrs. F. Schur, Mrs. Hattie Sullenger, Mrs. E. E. Van Voorhis, Mrs. Lizzie Thornton, Miss Pollie Walker, Mrs. R. G. Westervelt, Mrs. John Whalen, Mrs. A. Wilkinson, Miss Lulu Wylie, Miss Isabella Youngs.
Indian: C. B. Boyd, M. D., Z. T. Daniel, M. D., Andrew Pat, Ceca Yammi.
Inspector: Edw. F. Beach.
Insurance Agent: F. C. Bellin, S. W. Jones, F. W. Munford.
Interpreter: Edw. W. Krautz.
Journalist: Ricardo Charlin.
Judge: D. C. Hawk.
Laborer: W. L. Barnden, Francisco Castro, Alez. Coochman, Alex. Cooper, Toribio Cruz, James W. Cullins, Charles G. Dalrymple, Gerardo Dauma, A. Edquist, Rafael M. Espinoza, R. C. Evans, Jonas Greenhill, William Hanlon, Daniel W. Knowles, Alva M. Lindsey, A. B. Lynch, Leandro Martinez, J. C. Mathis, Pierre Mimmo, John Moore, William Mooreside, William Morgan, William E. Nelson, John A. Nilson, Patrick Nolan, George H. Parren, R. T. Sayville, M. D., Joseph Smith, J. Strangeway, Samuel Taylor, Charles E. Tyrell, Thomas Williams, Michael Yuzsyzyn.
Lawyer: B. S. Briggs, W. L. Caldwell, Juan Cardoso, Stephen Kelsey, G. Lorenzoni, W. S. Reddy, G. Perez Rivero, J. B. Saxon.
Letter Carrier: H. F. Drake, C. L. Green, M. D., Thomas F. Lush.
Lighthouse Keeper: George W. Purdy.
Light Work: Vernon Knowles, William Morgan, William H. Potter, Charles E. Welsh.
Logging: Albert Maiden.
Lumber: William Hanlon, A. B. Lynch, Charles G. McCleary.
Lumber Merchant: Charles G. McCleary.
Machinist: Alex. Bagdriewics, M. B. Jarnagin, J. A. Jarratt, Frank Knowles, A. L. Naylor, Hugh Pike, E. P. Rice, M. D., George W. Shipper, Thomas W. Smith, A. H. Stephens.
Manufacturer: John MacArthur, J. Underwood.
Marketman: W. E. O'Brien.
Mason: Eli Brown.

Mechanic: D. M. Green, C. J. Hamilton, M. D., R. Peel, John T. Rice, Mat. Rice, Harry Robbins.
Medical Student: Jos. Lalung-Bonnaire.
Merchant: Antonio Alarcon, G. Bennett, Atala Cuzmar, David M. H. Deupree, William Dobson, T. S. Edwards, Frank S. Gillespie, C. B. Kingsley, Charles G. McCleary, M. A. Parraga, Mark W. Penny, E. O. Rentz, H. Van Ormondt, J. W. Vaughan.
Military: Matias Ahumada, Col. Juan de Dios Alvarado, J. T. Chirino, General Gregorio Carrera, Jose Ignacio Lara V., General Ramiro S. Gonzalez, Matthew Norton.
Milk Dealer: George A. Dawson.
Milk Tester: C. C. Dalrymple.
Millhand: John Birkmyer, Miss C. Dyson, William Hanlon, A. A. Jones, Matthew W. Sill, J. H. Willard.
Miner: Edw. Beaudry, T. L. Bilson, J. J. Booth, John Brennan, A. C. Clark, E. R. Corfield, D. O. Evans, John Fender, William S. Jones, J. M. Jordan, Sydney Joyce, Norman Lee, John McLean, James McMickle, S. M. Musselwhite, A. A. Quinn, Edw. Renwick, Walter Saunders, J. W. Taylor (both legs), Thomas Truscott, George Yates.
Motorman: N. Lee, John Marshall, Edwin D. Smith.
Musician: Charles Deifel, Thomas W. Keogh, Prof. Alex. von Skibinsky.
Music Teacher: Miss Amy Pimblett.
Newsboy: John Scharff.
Notary: G. Lorenzoni.
Nurse: Miss Hanna Fowler.
Office Work: Jose Antonio Feria.
Oil Well Pumper: Oscar Coins.
Organist: C. W. Nicholson.
Overseer: P. J. McCarthy.
Oysterman: Alden Biggs, A. W. Mills.
Packer: Frank J. Kunz.
Painter: Harry J. Breach, James Halpin, John B. Lawrence, Charles McClellan, Thomas E. Neville, Earl J. Oliver, R. H. Perry, A. F. Peterson, George W. Purdy, Charles C. Shenton.
Paper Hanger: James Halpin.
Pearl Worker: Leon Krasker.
Photographer: Charles A. Christie.
Physician: Dr. J. B. Aycrigg, Lieut. J. A. Bailey, Dr. J. Lalung-Bonnaire, C. C. Bose, M. D., W. A. Clark, M. D., Robert T. Davidson, M. D., William B. Davis, M. D., Dr. H. E. Eldridge, J. W. Farrill, M. D. (arm), Dr. M. Lauritzen, L. B. McBrayer, Dr. Maximiliano Machada, J. B. McIntyre, M. D., Dr. C. E. Smith, Dr. E. G. Zey.
Picture Framer: David Gluck.
Pilot: J. H. Brown.
Plasterer: James D.
Plumber: George M. Burke.
Policeman: Jos. T. Appleton, Paul R. Garside.
Porter: Thomas H. Morgan, Julius M. Richards.
Postmaster: Alfred Crewe, J. A. McDonald.
Poultry Farm: I. J. Marks, Harry Robbins.
Priest: Rev. J. F. Dobson, Rev. Charles B. Veillet.
Printer: Ramon Gamboa, Archer R. Johns, T. H. Palensky, J. E. Roper, G. W. Wright, John B. Young.
Produce Dealer: Stanley J. Sanford.
Proof Reader: C. A. Sargent.
Pumper: N. Lee.

Quarryman: John McLean.

Railroad: F. J. Bonner (switchman and signalman), William J. Bryan (conductor), Dan Cobb (brakeman), Daniel A. Daly (shop hand), Thos. Dabson (engine brakeman), Jack Diamond, Ira Edgar (conductor), Luis Estrada (conductor), F. Faust (fireman), Manuel R. Gonzalez, H. J. Holden (flagman and lineman), Charles J. Hymison (brakeman), A. A. Jack (agent), Jose Maria Jorge, Dr. Ladbury (flagman), Wm. Lezotte (gate tender), Daniel Mahoney (brakeman), L. D. Marshall, George Martin (switchman), Alex. McDonald (engineer), William McGettiner (engineer), H. R. Newell (engineer), Jose Ortiz (electrician), Louis Paris (flagman), A. H. Plemons (brakeman), William Roberts (chief dispatcher), Fred Rush (agent), A. B. S., F. B. Scroggins, Selah L. Smith (locomotive hostler), Thomas H. Smith, Walter L. Smith (switchman), Hamp Stephens, William Sullivan, John L. Thomas (baggageman), R. E. Thompson (official), Arthur Tipping, James Tobin.

Ranchman: Cedric Kirkpatrick, E. P. Low, Ernest Zagelow.

Real Estate: Edw. E. Bownes, William Campbell, Hector MacFadyn.

Restaurant: C. J. Doyle.

Road Builder: A. Wright.

Roll Turner: Thomas F. Prosser.

Rolling Mill: A. W. Weaver.

Roper: E. P. Low.

Rural Delivery Carrier: H. T. Drake, Thomas F. Lush.

Salesman: Gus E. Conrad, Dr. S. W. Dodge, Sidney E. Prest, Mr. Lizette.

Saloon Keeper: Charles J. Hanley.

Sash and Door Manufacturer: John MacArthur.

Sawfiler: J. W. P.

Sawmill: T. F. Forster, A. A. Jones, C. L. Linville, J. W. P.

Sawyer: Elijah Hedgeman.

Sealer: Hugh Thompson.

Seamstress: Mrs. B. J. Shurtleff.

Secretary: G. R. Champerdowne.

Sexton: James Baxter.

Sheep Herder: George Coleman, Price Nelson.

Shoemaker: James R. Brunette, Alex. Coleman, Alfred Crewe, Silas W. Fickel, Wm. Fiddler, E. A. Gallup, Charles Gillespie, Robert Haak, Daniel W. Knowles, Frank Porter, Jos. Smith, Dr. A. F. Storey, Bernard Talbot, J. Veilleux, H. V. T. Williams, H. R. Williams.

Shop Hand: Miss Nellie Presdee, Wendel Riska.

Signalman: Arthur James Earley.

Sign Painter: John J. Kelly.

Springmaker: Charles Salstrom.

Stableman: Tony Sapio.

Station Agent: George B. Garber, Fred Rush, J. J. Timmons.

Steamboat Hand: Gerardo Dauma.

Stenographer: Raymond C. Glass, D. W. Hoegg, Ralph E. Locke, E. L. Ramsey, William Storey, Jr.

Stockman: E. R. Bingman, L. H. Harkey, John W. Kent.

Stone Cutter: Charles F. Cole.

Stone Mason: R. Wood Jenkins, J. W. Winn.

Storekeeper: Ed. Chipman, W. T. Corey, W. L. Corgan, Robert Jackson, Richard Richards, George W. Steinmetz.

Street Sweeper: John Matthews.

Structural Work: Charles F. Cole.

Student: Annie N. Asselin, Carl Boysen, O. A. Dickson, M. D., J. de Menezes Freitas, C. W. Gallinger, J. L. Hedgepath, R. W. Holden.
Sugar Factory: T. Ccuz.
Surveyor: George R. Goddard.
Switchman: George Martin, Walter L. Smith, Arthur Tipping.
Tailor: Peter Anderson, Walter C. Brooks, George H. Hurst, S. J. Keith, Mark Kelly, John McLay, George Thomas Pennell, Manuel Prado M.
Tanner: L. C. Distler, M. D.
Tap, Die and Punch Maker: John B. Lawrence.
Teacher: C. X. Burgos, Miss Annie Eddy, C. W. Ford, James T. Gibson, David Howland, J. J. M. Kiernan, Miss E. M. Miller, J. Wesley Potter, Albert Pottle, B. F. Puckett, H. D. Unangst, Artemio Vasquez, A. W. Watton, Raymond R. Weaver, M. B. Wells.
Telegraph Operator: William L. Canfield, C. C. Crane, Howard L. Hoover, F. M. Kelleher, B. F. Kendall, W. T. McDonough, M. E. Martin, Edw. Noonan, Jos. S. Poirier, George Russ, A. K. Sutton.
Telephone Inspector: H. J. Holden.
Tightrope Walker: F. E. Jacoby.
Time Keeper: W. C. Cooper, Alex. E. Jackson, Patrick O'Brien.
Toolmaker: John H. Valentine.
Traveling Salesman: Hudson Dickerman, S. A. Wing, A. W. Weaver.
Treasurer: John C. Hamilton, Ala O. Mosier.
Truckman: Thomas Cahill, Charles F. Read.
Typewriter: R. C. Glass, Ralph E. Lock, Edw. Noonan, E. L. Ramsey, George Russ, William Storey, Jr.
Violinist: Prof. Alex. von Skibinsky.
Violin Maker: Jos. W. Balmes.
Warehouseman: Bernard Smith, Fred Swallow.
Watchmaker: J. B. Bissonnette.
Watchman: John T. Halsell, M. D., John Jennings, John Newstubb, Felippe Padrone, C. F. Roberts.
Weaver: Miss Blanche Baker, James Burton, G. H. Hurst.
Weigher: Sidney Nicholls.
Well Driller: James H. Smoot.
Wireman: Perry Cole.
Wire Stitcher: Fred H. Adams.
Wood Finisher: H. Trageser.
Yard Clerk: James A. Murta.
Yardman: Fred Furness.

These have mentioned in their testimonials what they have done in the sporting way:

Miss Edith Barrett, leg amputated, plays tennis.
Henry H. Daigle, leg amputated, goes hunting.
Ramon Gamboa, both legs amputated, plays billiards.
F. E. Jacoby, leg amputated, walks tightrope and skates.
J. M. Jordan, foot amputated, goes hunting.
James Lahive, leg amputated, bowls.
John Marshall, arm amputated, runs motorcycle.
James McDonald, both legs amputated, plays ball, goes boating, fishing, hunting, skating. Rides a bicycle.
Leslie Palmer, leg amputated, hunts, fishes, climbs mountains.
Harry Robbins, foot amputated, rides a bicycle and hunts.
Louis W. Selig, leg amputated, skates, rides a bicycle.
Philip Sheridan, leg amputated, walked 40 miles.
George W. Shipper, leg amputated, walked a foot race and won.
Walter L. Smith, arm amputated, plays pool, dances.

Charles E. Welsh, leg amputated, plays golf, bowls, rides a bicycle and skates.
Dr. G. W. Wright, leg amputated, rides a bicycle.
Dr. E. G. Zey, leg amputated, hunts.

5th Contention

MARKS ARTIFICIAL LIMBS ARE SUITABLE WHEN BOTH ARE AMPUTATED:

The spring mattress rubber foot without ankle articulation affords many advantages to those who are deprived of both their limbs. The large surfaces of the soles of the feet are better bases to rest upon when standing and balancing than the articulating feet which are like pivots. In walking, the rocker motion of the rubber foot is more of a help than the flopping of the wooden foot. These conditions are of especial advantage to those who are amputated above the knees.

P. S. Berges, born without legs; Archie Bungy, both legs; Carlos X. Burgos, both legs; Mrs. F. Cardinal, both legs; Juan Cardoso, both legs; Hudson Dickerman, both hands; John Dunn, both feet; Louis Fournier, both at ankles; Clarence W. Gallinger, both legs; Ramon Gamboa; David Gluck, right leg below knee, left foot at ankle; Harry Gregson, both legs; R. D. Hamilton, right leg at instep, left below knee; J. E. Hesselman, both below knees; H. F. Hicks, both below knees; Alex. Jackson, leg above knee and foot at ankle; Rev. G. H. Kennedy, both below knees; James McDonald, both legs; George A. McMahon, both above knees; Price Nelson, both below knees; T. E. Neville (painter, climbs ladders), right at knee, left below knee; W. S. Reddy, both legs; Jose Rios, Dr. Louis Ros, both below knees; Thomas H. Smith (weight 220 pounds), both below knees; A. E. Sykes, both below knees; J. William Taylor, right below knee, left in knee; Frank Triacca, both below knees; George G. Twitchell, both below knees; George Wanamaker, both below knees; L. C. Watson, right at ankle, left below knee; J. Webster, leg and arm; Charles Wilkin, both feet at insteps.

6th Contention

MARKS ARTIFICIAL LEGS ARE SUPERIOR FOR HIP JOINT AMPUTATIONS:

The Pelvic Socket and hip joint artificial leg for hip joint amputation is a proved success as attested by A. J. J. Austin, M. D., Miss Ethel Bairstow, Edgar Broadley, Grace Duff, D. C. Hawk, William E. C. Heym, Miss Minnie Osborne, A. H. Stevens, Dr. L. F. Woodward.

7th Contention

MARKS RUBBER FEET AND ALUMINUM SOCKET LEGS THE BEST FOR ANKLE JOINT AND PARTIAL FEET AMPUTATIONS:

So testifies Andrew C. Apgar, Martin Baal, Edw. E. Bownes, C. A. Brown, William L. Canfield, Charles A. Christie, Alex. Coochman, M. D. Dowell, John Dunn, James Earley, A. J. Eckles, Miss Annie Eddy, A. Edquist, Dr. R. G. Floyd, Louis Fournier, R. C. Glass, Robert D. Hamilton, Edw. Harris, D. M. Hilyard, H. J. Holden, James Jeffrey, J. M. Jordan, Sydney Joyce, W. J. Kraft, Corbette Legge, William Lezotte, C. L. Lineville, Daniel Mahoney, L. D. Marshall, H. E. Martin, Dr. L. B. McBrayer, Charles McClellan, Felipe Montes de Oca, G. R. Moses, John Newstubb, C. Nicholson, Albert Pottle, Thomas R. Rains, Charles Reed, Edward Renwick, Harry Robbins, R. D. Rogers, John Scharff, F. B. Scroggins, Charles C. Shenton, Harry W. Smith, Thomas W. Smith, James H. Smoot, L. L. Stewart, William Storey, Jr., William Sullivan, John L. Thomas, Arthur Tipping, John H. Valentine, Charles Wilkin, Harry V. T. Williams, S. A. Wing.

8th Contention

RUBBER HANDS FOR PARTIAL HAND AMPUTATIONS ARE THE BEST:

The desirability of using rubber hands when only parts of the hands have been removed is emphasized by many.

Frederick H. Adams, James H. Adams, F. C. Ballin, C. A. Brown, Hudson Dickerman, Dr. C. A. Dresch, Mrs. Arthur B. Joseph, Mrs. G. Kraska, John Murray, Prof. A. Von Skibinsky, John Sirok, Edw. C. Terry. E. E. Van Voorhis writes that Mrs. Van Voorhis is lost when hand is off. When she wakes up at night and sees it off, she gets up and puts it on. J. W. Vaughan, H. F. Watson, M. B. Wells, C. A. Zellner.

9th Contention

WATERPROOF LIMBS MADE ONLY BY MARKS SHOULD BE SELECTED:

Edw. Beaudry, W. A. Griffin, F. J. Holden, C. Legge, L. D. Martin, J. E. Musson, A. A. Quinn, Harry Robbins, who goes hunting through swamps, etc.; Edw. C. Terry, who works with an artificial hand in water and grease; Mrs. Fred V. T., who uses her leg while in bathing; Jos. M. Underwood (farmer), who works in all kinds of weather.

10th Contention

RUBBER HANDS ARE THE MOST NATURAL IN APPEARANCE AS WELL AS USEFUL:

So writes J. A. Bailey, M. C. Gallo, Charles J. Hanley, Mrs. Karoline Harmon, Wilson Jones, Mrs. A. B. Joseph, R. H. McKinnon, W. E. O'Brien, Walter L. Smith.

11th Contention

MARKS ARTIFICIAL ARMS FOR AMPUTATIONS ABOVE THE ELBOW ARE USEFUL AS WELL AS ORNAMENTAL:

It is not generally considered that an artificial arm is of very much practical value when the amputation is above the elbow joint. Although we do not claim a great amount of utility aside from ornament and the healthful influence they exert on the stump, it is a fact that many persons derive considerable service from them as testified to by Charles E. Chamberlain, Peter Champagne, Keith Edwards, Rev. E. W. Hawthorne, Connie Jent, Ala O. Mosier, Jacob Mumm, Mrs. Lulu Oldham, E. J. Oliver, C. E. Prather, J. W. Potter, George W. Purdy, J. A. Quigley, George W. Sowers, P. C. Thomas.

12th Contention

MOTIONLESS ANKLES MOST HELPFUL AND MOST ECONOMICAL:

It seems hardly necessary to make this statement, as it is self-evident that the least amount of complication in any structure renders that structure stronger, lighter and more dependable. In regard to the advantages of artificial legs with rubber feet without ankle joints communicate with Leslie Langill, Mrs. C. Lorenzen, John MacArthur, who states that an artificial ankle motion is bound to be noticeable, more so than the rubber foot. Albert Maiden, Edward McGonigal, John T. Rice.

13th Contention

THE SIMPLICITY OF MARKS MECHANISM MAKES LIMBS THE LEAST TROUBLESOME:

Some put special stress upon the less troublesome side of the question. They are as follows: A. R. Jones, W. T. McDonough, William McGettigan, George S. Poirier, E. W. Spedding.

14th Contention

MARKS RUBBER FEET INSURE FURTHER AND FASTER WALKING:

Some attach importance to their ability to walk further and faster on the rubber foot without ankle motion, than on any other kind. John Jones, Mrs. Regina Mehl.

15th Contention

MARKS LIMBS THE BEST FOR DANCING:

Many value their artificial legs with spring mattress rubber feet on account of their ability to dance gracefully and enjoyably. Probably there is nothing that puts an artificial leg to greater strains and stresses than the quick, twisting movements on the foot required in dancing. So writes Antonio Alarcon, Miss Edith Barrett, John Burkley, G. Carrera, J. D. Conger, M. D., Miss Betty Doughty, F. J. Holden, W. Hymison, S. M. Musselwhite, L. Palmer, R. Peel, E. Sanchez, John Sheahan, Walter S. Smith.

16th Contention

RUBBER FEET AND HANDS NOT AFFECTED BY EXTREME CLIMATES:

The question often comes up: "Is the rubber foot or the rubber hand a safe one to use in hot or extremely cold climates?" Unreasonable as this question is, it nevertheless must be answered and we can do no better than refer those who wish to know to parties who are living or have lived for years in the coldest as well as the hottest parts of the world. Probably Manitoba is as cold as any inhabitable spot on the earth and as for extreme heat, India, Central America, West Indies and the northern part of South America can be regarded as the most intense for either dry or humid atmosphere. The simple fact that the rubber foot and rubber hand are neither conductors of heat nor absorbents of moisture makes the Marks Limbs immune to weather conditions, either hot, cold, wet or dry. Rubber is not injured by cold or dampness and only heat intense enough to boil water will affect its elastic permanency.

Letters from the extremes of the world in climatic conditions have been written by the following:

A. J. J. Austin, M. D., Mexico; Adolph Bernauer, Canada; J. M. Dulante, Peru, South America; John Fender, Alberta, Canada; W. Fiddler, St. Vincent, B. W. I.; Paul H. Garside, India; many in Newfoundland, many in Panama, West Indies and Central America. R. Gomez, Central America; Gen. R. S. Gonzalez, Venezuela, South America; W. Hymison, Panama; C. B. Kingsley, Saskatoon, Canada; J. A. Knowles, Santa Domingo; Jose Ignacio Lara V, Ecuador, South America; Dr. M. Machada, Brazil, South America; M. E. Martin, India; K. Manchurian, Turkey in Asia; G. Ochoa, Mexico; Manuel Prado, Costa Rica; S. E. Prest, Manitoba, Canada; Fred Rush, Manitoba, Canada; Francisco Silva, Salvador Republic, Central America; William Storey of Wyoming, U. S. A., had to walk to keep from freezing; Artemio Vasquez, Porto Rico; J. B. Wessels, South Africa; Isaac Winfrey, who as fireman works in front of a furnace under intense heat.

17th Contention

MARKS ARTIFICIAL LIMBS ARE MOST UP-TO-DATE AND ARE CONTINUALLY BEING IMPROVED:

Although the Marks Artificial Limbs made half a century ago were excellent, they have been improved continually and are better now than ever before. The motive of 1853 to make limbs strong, light, efficient and as free from complication as possible is as strong today as it ever was as attested by:

W. L. Agnew, Martin Baal, Miss Alice E. Bacon, Alex. Bagdriewics, W. L. Canfield, Mrs. Grace Carsley, Alfred Crewe, William Griffin, A. A. Jones, Leon Krasker, Wolf Lorenzen, Felipe Montes de Oca, J. A. Murta, George W. Oman, A. T. Peterson (arm), Jos. S. Poirier, J. M. Richards, John Sheahan, R. E. Thompson, A. J. Zabriskie, E. Zagelow.

18th Contention

MARKS ARTIFICIAL LIMBS ARE MOST SUITABLE FOR HEAVY PERSONS:

Letters of testimony show that the Marks Artificial Leg can be made strong enough without being excessively heavy for men of great weight occupied in active work as stated by:

James W. Cullins, 242 pounds; Archer R. Johns, 200 pounds; Frank J. Kunz, 220 pounds; Thomas F. Lush, 165 pounds; Hester MacFadyn, 175 pounds; Albert Maiden, 239 pounds; John McKays, 212 pounds; A. F. McNaughton, 235 pounds; Thomas F. Prosser, 175 pounds; Thomas H. Smith, 220 pounds (both legs); Mrs. John Whalen, 213 pounds; S. A. Wing, 200 pounds.

19th Contention

MARKS LIMBS ARE THE LIGHTEST:

When required for delicate persons, the Marks Limb can be made the lightest and still be substantial. R. V. T. Buck, Gerardo Dauma, leg obtained elsewhere weighed 7½ kilos, Marks only 3 kilos. Miss Polly Heald, Jose Ortiz, Thomas F. Prosser, L. Restrepo.

20th Contention

MARKS ARTIFICIAL LIMBS ARE THE BEST FOR ELDERLY PERSONS:

As stated in other publications, the advisability of applying artificial limbs to elderly persons cannot be emphasized too strongly. A few testimonials on this subject are worth considering. They provide ample proof in support of our contention that a person of advanced years who has lost a limb will enjoy better health, be more contented, happier and less dependent on others by having and wearing an artificial limb as affirmed by:

Samuel Berry, aged 67, who writes he carries a small drum and marches in funerals; H. T. Drake, aged 70, occupation Rural Delivery Carrier, takes care of his own horse and drives daily 25 miles. Jacob G. Shirk, aged 76, drives four-horse disk-harrow.

The testimonials of the following are interesting: Hosea Beach, aged 84; A. B. Boren, aged 70; Eli Brown, aged 76; Mrs. J. B. Clarke, aged 70; David M. H. Deupree, aged 72; W. Fickel, aged 69; Rev. Oscar Gesner, aged 75; D. M. Green, aged 76; William Griffin, aged 71; George W. Hart, aged 71; Hoff, aged 70; Henry F. Hicks, aged 72; H. C. Hoff, aged 72; J. A. Jarratt, aged 74; C. S. Judy, M. D., aged 70; John MacArthur, aged 67; A. E. Magoffin, aged 70; W. M. Scandret, aged 76; Jacob G. Shirk, aged 76; Mrs. Mary A. Smith, aged 77; Hugh Thompson, aged 73; John B. Young, aged 72; A. J. Zabriskie, aged 64.

21st Contention

MARKS ARTIFICIAL LIMBS ARE BY FAR THE BEST FOR CHILDREN:

The Marks Artificial Legs and Arms have always been the best for young and growing children, either girls or boys. The strong, simple construction with few mechanical parts makes them preferable on account of the readiness with which they can be enlarged to accommodate the growth and development of the wearers.

The Waterproof Feature is of additional advantage. Young, growing children who are in good health, despite the fact that they are wearing artificial limbs, will run about, romp and play with other children in all kinds of weather, summer or winter, rain or snow, cloudy or sunshine. They are thoughtless and will get their artificial limbs wet and before they think of it the limbs are soaked. Artificial limbs of ordinary construction soon go to pieces under this treatment, but the Marks Waterproof Limbs will not be injured. It has been the experience of some families, who have procured artificial limbs of ordinary construction for their children, that the expense of keeping them in order was too much for their meager resources and in many cases they have required their children to abandon their limbs and get about on crutches. This is probably the most unwise and cruel thing a parent can do. Crutches support the body from under the arms and the use of them for a number of years is likely to distort the body, injure the lungs, weaken the chest and if only one crutch is used, the spine is likely to become curved. With a Marks Artificial Limb the objection on account of cost of maintenance is almost eliminated, and the weight of the body is applied to the perineum, where it should be.

The testimony of a number of the writers is to the effect that it is better to bring up a child on an artificial leg than on crutches, and that the Marks Waterproof Artificial Leg is the one to select on account of economy and facility with which changes can be made for growth.

W. Belworthy says his daughter was 3½ years old when she first put on an artificial leg. She is now 17 years old. Cosmost T. Cartwright was six years old when he obtained his first leg. Read his letter written after he had reached his manhood. Felix M. Sidara, aged 10, won a $10 prize in a bicycle race, although wearing an artificial leg. Brooke Steele says that artificial legs for growing children are better than crutches. Frank Triacca, aged 13, both legs amputated. Floyd Turner writes a letter on the benefits of wearing an artificial arm, aged 12.

Miss Fanny Adler, Joel Avant, E. R. Bingman, Albert Blakely, J. L. Bonnaire, J. J. Booth, William J. Bray, Rev. G. W. Brownback, H. J. Cardinal, Grace Carsley, George Coleman, Arthur C. Croll, Miss Lean Dagenhart, H. F. Datesman, M. D., W. B. Davis, M. D., G. Duxbury, C. F. Frey, Mrs. F. N. Glass, Ray W. Holden, David Howland, Stephen Kelsey, William F. Kleckner, Mary Lavorata, S. J. Levenson, Wolf Lorenzen, L. D. Martin, Dr. William Mackechnie, John F. Mellor, C. E. McCoy, M. D., Otto Meyer, M. Parraga, Edw. F. Perreau, Miss Grace M. Phipps, Miss Julia Pittel, Augustin J. Prieto, W. L. Ramsey, John Scharff, L. M. Selig, Felix M. Sidari, A. Siracusa, J. M. Smith, Jos. H. Steell, M. Spinelli, Arthur Tomlinson, Floyd Turner, A. Vasquez, J. H. Willard, P. S. Willson, M. D., L. F. Woodward, M. D., Miss Lulu Kate Wylie.

22nd Contention

RUBBER FEET CONDUCIVE TO HEALTH:

There are a great many persons who do testify and many more who are willing to, that wearing an artificial leg with a rubber foot contributes to health. The jar which results from walking on wooden feet works upon the nervous system, with some it causes headaches, others get tired quickly, in fact there are all kinds of troubles and complications ascribed to the wooden foot, but with the spring mattress rubber foot, this jar is entirely removed.

A clean socket has much to do with the health of the stump. Soft leather as well as padded sockets absorb perspiration, become foul and fetid, they not only emit a disagreeable odor, but are unhealthful

to the stump and are likely to infect it. The willow socket of the Marks type is sanitary and proof against these conditions.

William Allison says the willow socket arm is cleaner and more healthful than the leather socket arm he had worn previously; perspiration does not foul wood as it does leather. George W. Oman writes that he was troubled with boils when he wore an artificial leg with wooden foot. He became very much alarmed, did not know the cause, his doctor advised him to try the rubber foot, which he did. Immediately thereafter the boils disappeared and he has not had a recurrence. He attributes this to the absence of jar with the rubber foot. H. C. Hoff, aged 72, says that walking with the Marks Rubber Foot is a comfort and pleasure, and therefore he does more of it, which improves his health. M. J. Lowe writes that before he wore an artificial arm he suffered much from nerve troubles in his stump. By wearing an artificial arm and exercising his stump, conditions have improved and he is in better health.

Mrs. A. Armitage, H. F. Datesman, M. D., Miss Annie Eddy, P. A. Garside, M. J. Jorge, Leon Krasker, E. E. Roberts.

23rd Contention

MARKS GUARANTEE ABSOLUTELY RELIABLE:

Letters in too many cases to mention certify to the reliability of the Marks Guarantee. Every promise made by the house is faithfully fulfilled and in many cases the results derived far exceed all promises or even expectations.

G. R. Champerdowne, A. C. Croll, William Griffin, James Jeffrey, Connie Jent, A. L. Naylor, Miss D. F. Webster, H. R. Williams.

CHAPTER XXXVIII

GEORGE HY. BARSTOW, BRITISH REPRESENTATIVE

GEORGE HY. BARSTOW—Birkin House, Franklin Mount, Harrogate, Yorkshire, England, REPRESENTATIVE FOR A. A. MARKS IN GREAT BRITAIN. Below knee. Wears E-17.

I had my leg amputated in 1884. I had worn a number of artificial limbs of English construction when I met a person wearing one of your make. I became interested in the way he walked, it seemed as though every step he took was more like nature than any I had ever seen, much more so than the leg I was wearing. He wore the spring mattress rubber foot and I wore the ankle jointed wooden foot leg. I immediately sent my measurements to you and had a leg made. It came promptly. I put it on and wore it from the start with comfort. I immediately became an enthusiastic walker and before I knew it and without any intention of soliciting orders for you, parties came to me and wanted me to order for them. I did so and in a short time found that my services were in demand.

I wrote you and asked for the agency of Great Britain. You gave it to me. Since then I have ordered of you 380 artificial legs and arms for parties residing in England, Scotland, Ireland and Wales. The work is exceedingly pleasant and satisfactory to me, because I feel that I am doing much good to amputated persons in Great Britain.

Perhaps it will be well for you to have the report from the Honorable Matron of the Brotherton Hall Hospital. Here it is:

REPORT FROM DR. KATE MITCHELL WEST
Honorable Matron
BROTHERTON HALL HOSPITAL FOR WOUNDED BELGIAN SOLDIERS

Brotherton, Yorkshire, October 4th, 1916.

The Artificial Limbs manufactured and exported by the A. A. MARKS FIRM, of New York, U. S. A., and introduced into this country by their well-known and energetic representative, MR. G. HY. BARSTOW, of Harrogate, Yorks, have been supplied to wounded Belgian soldiers during their residence at Brotherton Hall Hospital and have brought the utmost satisfaction not only to the wearers thereof but to the Medical Staff.

These Marks Limbs are infinitely superior to any that the undersigned has seen supplied by the English manufacturers—by reason of their perfect mechanism and splendid adaptability to varying requirements and circumstances. They are designed and manufactured on sound scientific mechanical principles.

A man with a Marks Leg (thigh amputation) is not prevented from carrying on his usual avocation, or in joining in athletic games, etc. As a matter of fact, it is difficult to discern the presence of an artificial limb when the wearer has become thoroughly accustomed to its use—which he does in a very short time.

In two words these Marks Limbs are *sui generis* and should certainly be widely known and generously patronized, more particularly in these times of amputated limbs when every ounce of a man's value must be preserved for his future use.

KATE MITCHELL WEST, L. R. C. P. I.,
Bac. es. Ars.; M. I. S. A., Etc

I have eighteen reasons why your make of artificial limb should be preferred to all others. They are as follows:

They are fitted upon scientific principles by competent and skilled fitters, who are familiar with the anatomy of human stumps, and are consequently the most comfortable to wear.

They obviate concussions to stumps. The sponge rubber foot affords a yielding medium upon which to walk and alight without jarring.

The method of fitting and construction does not require the use of strangulating or choking slip-sockets to keep the stumps from abrading.

They are noiseless. The absence of complicated ankle joints removes absolutely the tell-tale thud, thump and flop which are very objectionable features in other artificial legs.

They will stand more exposure to heat, cold and moisture than any other.

They are reliable to stand upon, and do not give a sensation of toppling over nor do they bend treacherously at the knees.

They help in walking. In springing from the heel to the toe, progress is aided and not impeded.

They can be adapted to stumps of any length, from a partial foot amputation to a hip-joint excision.

The methods of suspension are contrived to not only securely hold the legs, but "give and take," to avoid dragging at the shoulders.

They are not only light but strong.

They are durable. Their methods of construction combine strength without increase of weight. They are practically unbreakable.

Their method of construction admits of changes being made in length to accommodate the growth of the wearer, when such growth takes place. This is absolutely necessary for children.

The hands being made of rubber and cast in molds which are made from natural hands, have a finer resemblance to natural hands than those carved out of wood.

The rubber hands do not wear out the gloves as quickly as wooden hands, the material being soft and yielding to contact.

The fingers can be placed in many accommodating positions, and the fingers being made ductile, will respond to pressure communicated to them by the opposite hand.

The hands can be removed without removing the arm, and useful implements can be placed in the forearm or in the palm of the hand.

The rubber hand is soft to the touch, and doesn't produce harsh or unpleasant sounds when coming in contact with other objects.

The fingers do not break if the hand strikes a hard object.

NOTE: Persons in Great Britain in need of artificial limbs are referred to Mr. Barstow. He will upon request send literature, make appointments, take measurements, apply limbs and instruct persons in using them.

A. A. MARKS.

CHAPTER XXXIX

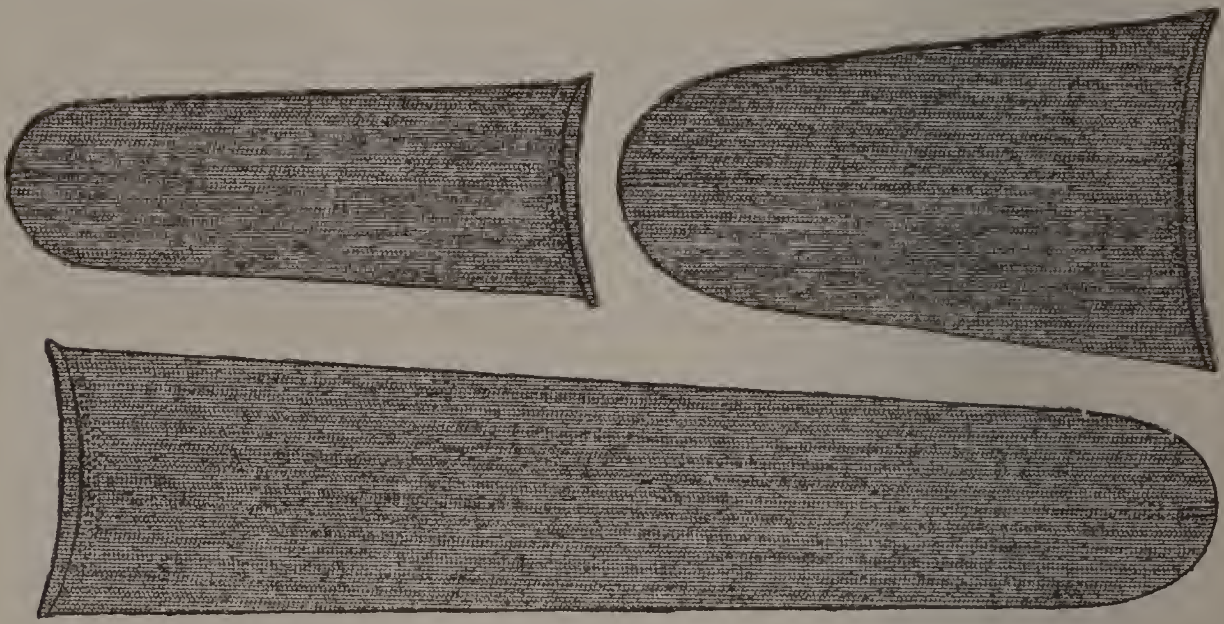
STUMP SOCKS. FOR ARTIFICIAL LIMB WEARERS

COTTON, WOOL, AND SILKATEEN

A stump bears the same relation to an artificial leg that a natural foot does to a shoe. Comfort and cleanliness demand that a sock should be worn on the stump, the same as on the foot.

A sock in either case provides a medium for collecting and absorbing the particles of waste and moisture that are thrown off from the skin, and by removing the socks, airing, and frequently washing them, the stump will be kept in a more healthy condition, and the socket of the leg will be better cared for.

There are persons who do not use socks, but wear their artificial limbs directly to their stumps, and permit the sockets to collect and absorb the excretions of the skin, and when the sockets become foul with the collection of effete matter, they are scraped out and



revarnished. This method cannot be condemned too strongly. The stump, as well as the artificial leg, suffers from such treatment.

Every wearer of an artificial limb should be provided with an ample supply of socks, so that frequent changes can be made. The same regard should be given to the stump as is given to the natural foot. If a stump perspires excessively, changes should be made more frequently.

We manufacture our own socks, and keep a large stock on hand and are able to fill orders promptly.

Our socks are made of cotton, wool, and silkateen.

Cotton socks are knit of choice staple, they are durable and pleasant to wear; they are preferred by those who cannot endure wool.

Woolen socks are knit from yarn especially prepared for the purpose; the yarn is the best and softest that can be procured, with only enough twist to make it wear well. It is absolutely free from cotton or any foreign fiber.

Silkateen socks are made from exceptionally fine thread, they are knit on a machine constructed for the purpose; meshes are small, sixteen stitches to the inch, much finer than socks made from cotton

or wool. These socks are especially suitable for tender and delicate stumps. Silkateen is a comparatively new thread; it is strong and will stand the effects of wear a great length of time. It has a luster resembling silk; it is very smooth and soft to the touch.

Cotton and woolen socks are made in two colors, white or brown, silkateen socks are of a natural grayish tint.

Our stock consists of eleven different sizes, ranging from ten to thirty-six inches in length, and in width to fit any ordinary limb.

In ordering socks the following measurements should be given:

Length of Sock. Circumference at top of Stump, 4 inches from top, 8 inches from top, 12 inches from top, 16 inches from top, 20 inches from top, 24 inches from top, 28 inches from top.

Some persons use a long sock to cover the stump to the body, and a shorter one to cover the stump to the joint (knee or elbow).

When a short one is needed, give only the length and circumferences of that part of the limb that is to be covered.

The following schedule will enable anyone to determine the sizes and the prices of the socks required.

PRICE LIST OF STUMP SOCKS

Sizes in inches.			Cotton.		Silver		Woolen or Silkateen.	
Size No.	Length of sock.	Circumference at largest part of stump.	Price each.	Per dozen.	Price each.	Per dozen.	Price each.	Per dozen.
0.	1 to 10	Under 15	$0.25	$2.50	$0.40	$4.00	$0.60	$6.00
1.	10 to 15	" 15	35	3.50	.50	5.00	.70	7.00
2.	10 to 15	Over 15	.45	4.50	.60	6.00	.80	8.00
3.	15 to 20	Under 15	.45	4.50	.60	6.00	.80	8.00
4.	15 to 20	Over 15	.55	5.50	.70	7.00	.90	9.00
5.	20 to 25	Under 15	.55	5.50	70	7.00	.90	9.00
6.	20 to 25	Over 15	.65	6.50	.80	8.00	1.00	10.00
7.	25 to 30	Under 15	.65	6.50	.80	8.00	1.00	10.00
8.	25 to 30	Over 15	.75	7.50	.90	9.00	1.10	11.00
9.	30 to 35	Under 15	.75	7.50	.90	9.00	1.10	11.00
10.	30 to 35	Over 15	.85	8.50	1.00	10.00	1.20	12.00

Sent postpaid if remittance accompanies the order.

One-quarter or one-half dozen of the same kind and size sold at dozen rates. In some cases of amputation below the knee, a short sock in addition to a full length one to come only to the knee joint is desired. For such cases No. 0, 1 or 3 will be suitable. In determining the number of size, 5 inches should be added to the length of stump to allow for turning over the top of leg and the shortening caused by the stretch in drawing on the stump.

SUPPLIES FOR ARTIFICIAL LIMB WEARERS

Elastic Webbings, 2 inches wide, 80c. per yard; 1½ inch wide, 70c. per yard; 1 inch wide, 60c. per yard.

Non-Elastic Webbings, 2 inches wide, 40c. per yard; 1½ inch wide, 35c. per yard; 1 inch wide, 30c. per yard.

Clamp Buckles with Snap, 1½ and 2 inches, 25c. each; Snaps, 1½ and 2 inches, 20c. each.

Pronged Buckles, nickel-plated, for buckling in webbing, 2 inches, 1½ and 1 inch, 5c. each.
Roller Buckles, nickel-plated, for buckling in leather, ½, ⅝, ¾, ⅞ and 1 inch, 10c. each.
Knee-Side Joints, E-23, for below-knee amputations, $12.00 per pair.
Screws, Bolts and Bushings, for Side Joints; Screws A, 30c. per pair; Bolts B, 60c. per pair; Bushings C, 60c. per pair.
Check-Strap Lacings, for back of leg, amputation below knee, 40c. each.
Lacings of fine buckskin, 60 inches long, 40c. each; $4.00 per dozen.
Eyelets, 5-16 or ¼ inch holes, 10c. per dozen. Rings, Style A, B, C, or D, 20c. per doz.
Lacing Hooks, brass, nickel-plated, Style A or B, 50c. per dozen.
Pocket Oil Cans, 25c. each. Screw Drivers, 20c. each.
Knee Bolt Joint F 6, Bolt *a*, $3.00 each. Set Screw *b*, 10c. each. Check Cord Screw *c*, 20c. each. Check Cord *d*, $3.00 each. Piston *g*, 15c. each. Springs *h*, 25c. each. Cylinder *i*, 50c. each. Leather Cover, 10c. each.
Knee T-Joint H 17; T-Joint *a*, $5.00 each; Screws *b*, or *i*, 20c. each; Caps *c*, 25c. each; Piston *d*, 15c. each; Springs *e*, 25c. each; Cylinder *f*, 50c. each; Leather Cover *g*, 10c. each.
Suspenders, No. 835, $2.00; E 60, $2.50; E 61, $4.00; E 62, $5.00; H 28, with rollers and straps, $5.00; H 34, $4.00; H 35, $6.00; H 37, with rollers and cords, $7.00. Straps attached to Corset, 75c. each strap. Arm Suspenders, $3.00 each.
Suspender Rollers, A, B and C, 40c. each. Roller Straps, 36 inches long, 50c. each.
Peg-Leg Ferrule, complete, E 57, $2.50. Ferrule, E 58, $1.50 each. Rubber Tips, E 59, $1.00 each.
Arm Implements: Knife, $1.00 each; Fork, $1.00 each; Hook, $1.50 each.
Gloves, made of strong kid, $2.00 per pair; Single Glove, right or left, $1.50 each.
Felt for pads and linings, per square inch, 1-16 inch in thickness, ¼c.; ⅛ inch, ½c.; 3-16 inch, ¾c.; ¼ inch, 1c.

Socks and Supplies will be sent postpaid if remittance accompanies the order.

HOW TO REMIT

You can send postage stamps, money order, registered letter, express or draft on New York. No goods will be sent C. O. D. unless one-half the price is enclosed with the order.

Address: A. A. MARKS, 702 Broadway.
New York, U. S. A.

CHAPTER XL

HOW TO REACH OUR ESTABLISHMENT

We have endeavored to impress the fact that personal fittings for simple amputations are as a rule unnecessary, and that we do not advise anyone to go to the expense and annoyance incident to coming to us without first making an attempt to obtain a suitable artificial limb by measurements. In order to place the matter on a basis of safety to the wearer, we obligate ourselves to make all alterations and refittings (should they be necessary) without charge.

It is also emphatically stated that amputations leaving the stump with abnormal conditions, incapable of being explained either by drawings, descriptions or casts, are exceptions, fittings in such cases should be personal. Those who decide to come to us for personal attention will be welcomed and promptly attended to on their arrival.

WHERE WE ARE LOCATED.—We are located at 702 Broadway, N. E. corner of Fourth Street, a distance of less than two miles from every railroad and steamboat terminal. $1.00 or $1.50 is the most that can legally be charged for carriage or taxicab to convey a person to our door. Any person can, however, take a car at the point at which they arrive and be conveyed to Broadway and there transferred to a car that will stop at our door. Five cents will pay the fare. The system of transfers in New York is very convenient and accommodating.

WE MEET PATRONS.—We will meet any person on arrival, if we are made acquainted with particulars a day or two in advance, provided the arrival occurs during the day. If it occurs after business hours, it will be well for the person to go immediately to some reputable hotel near by and remain there overnight. The Broadway Central Hotel, 671 Broadway, is within 300 feet of our establishment.

BUSINESS HOURS.—Our establishment is open for business from eight o'clock in the morning to five o'clock in the afternoon, except Saturdays when we close at one o'clock. We are not open Sundays or holidays.

BOARDING AND LODGING.—Accommodations can be obtained at reasonable rates in New York City. Furnished rooms in private houses can be had for from $2.00 to $5.00 per week, table board can be had from $3.00 to $5.00 per week. Rooms in hotels vary from fifty cents to $2.00 per night, with board from $2.00 to $5.00 per day. A person coming to New York expecting to remain a week or more, and wishing to keep expenses down, can engage a furnished room and eat in restaurants, living expenses while here can thus be kept within narrow limits. The Mills House, located at 164 Bleecker Street, is within one-half a mile of us. This is one of a chain of hotels conducted for the accommodation of respectable men of small means. A room can be had for twenty cents per night and meals at fifteen cents each.

WHERE TO HAVE YOUR MAIL ADDRESSED.—Upon leaving home, instructions should be given to address letters and telegrams to the care of A. A. Marks, 702 Broadway, New York City.

Patrons have the liberty of our premises while in New York, and

if they are shopping, they can have their goods delivered at our store. They can make engagements to meet parties here and have the exclusive use of private rooms for private interviews.

CALLS MADE TO RESIDENCES.—Persons will be attended to at their residences, no matter where they may reside, if expenses and extra time are paid for.

WOMEN IN ATTENDANCE.—Women who prefer to be waited upon by one of their own sex, will find women in our office for their accommodation.

BRANCHES.—We have no manufacturing branches. Our factory is located in New York City and in no other place. Our skill and judgment cannot be relegated to one in charge of a manufacturing branch. If we were to establish branches we would have to place them under the management of others and would, more or less, jeopardize the welfare of our patrons. As substitutes for branches, our system of fitting from measurements has been devised and found adequate.

If the reader desires to order a limb and does not care to take measurements himself, he can call upon his physician or druggist, or upon one whom we will designate, and have measurements taken.

CAUTION

Artificial limbs with rubber hands and feet are the inventions of A. A. Marks and the members of the firm bearing that name.

The patents that are owned by the firm have the following dates:

March 7, 1854.	July 12, 1887.
December 1, 1863.	March 8, 1892.
March 7, 1865.	January 3, 1893.
November 16, 1880 (First).	September 17, 1895.
November 16, 1880 (Second).	July 9, 1912.
March 30, 1886.	June 20, 1922.

These patents not only cover the original inventions, but the more important improvements that have been made upon them.

The limbs have proved a blessing to the maimed. They stand peerless before the world. Over 53,000 have been put in use, and the verdict is overwhelmingly in their favor.

The large and increasing demand for Marks inventions has excited the envy of our competitors. Discarded inventions and expired patents of a quarter of a century ago have been more or less mutilated and offered as rubber feet, rubber ankles, rubber toes, pneumatic pads, etc., etc.

We advise all persons who are in need of artificial limbs to deal directly with us, and obtain the genuine and not submit to doubtful experiments.

Order should state that none but Marks artificial leg or arm will be accepted. The genuine bear the name of the firm and the dates of patents.

A. A. MARKS,

Established 1853. 702 Broadway, New York, U. S. A.

PRICE LIST

PRICES: ARTIFICIAL FEET AND LEGS

Artificial Feet for Partial Feet Amputations, described on pages 27 to 36.....	Cut C 2	each	$ 40.00
	Cut C 5	"	60.00
	Cut C 18	"	90.00
	Cut C 25	"	90.00
	Cut C 27	"	90.00
	Cut C 28	"	135.00
Artificial Feet for Ankle-Joint Amputations, described on pages 37 to 44...........	Cut D 7	"	90.00
	Cut D 12	"	90.00
	Cut D 14	"	90.00
	Cut D 16	"	90.00
	Cut D 21	"	135.00
	Cut D 23	"	135.00
Artificial Legs for Below-Knee Amputations, described on pages 45 to 69...........	Cut E 2	"	135.00
	Cut E 7	"	135.00
	Cut E 17	"	135.00
	Cut E 28	"	90.00
	Cut E 40	"	135.00
	Cut E 44	"	150.00
	Cut E 46	"	135.00
	Cut E 50	"	135.00
	Cut E 51	"	135.00
Peg Legs for Below-Knee Amputations, described on pages 67 to 71...........	Cut E 54	"	25.00
	Cut E 55	"	60.00
	Cut E 56	"	100.00
Ferrules and Rubber Tips for Peg Legs, described on pages 71 and 72.........	Cut E 57	complete	2.50
	Cut E 58	each	1.50
	Cut E 59	"	1.00
Suspenders, described on pages 71 and 72..	Cut E 60	set	4.00
	Cut E 61	"	4.00
	Cut E 62	"	6.00
Straps attached to corsets................ Or, $0.75 for each strap, corsets to be furnished by wearer.	Cut E 63	"	1.50
Artificial Legs for Knee-Bearing Stumps, described on pages 73 to 77...........	Cut F 5	each	135.00
	Cut F 9	"	135.00
Peg Legs for Knee-Bearing Stumps, described on pages 77 and 78............	Cut F 11	"	25.00
	Cut F 12	"	100.00
	Cut F 13	"	75.00
Artificial Legs for Disarticulated Knee Stumps, described on pages 79 to 83...	Cut G 7	"	135.00
	Cut G 8	"	135.00
Artificial Legs for Thigh or Femoral Stumps, described on pages 84 to 93...	Cut H 5	"	135.00
	Cut H 15	"	135.00
	Cut H 25	"	100.00
Peg Legs for Thigh Stumps................	Cut H 26	"	75.00
	Cut H 27	"	100.00

Suspenders, described on pages 94 to 97....	Cut H 28	set	$ 5.00
	Cut H 34	"	5.00
	Cut H 35	"	8.00
Straps attached to Vests .... Or, $0.75 for each strap, Vest to be furnished by wearer.	Cut H 36	"	3.00
	Cut H 37	"	7.00
Straps attached to Corsets................ Or, $0.75 for each strap, Corset to be furnished by wearer.	Cut H 38	"	3.00
Artificial Legs for Hip-Joint Amputations, described on pages 98 to 100..........	Cut I 5	each	150.00
	Cut I 7	"	200.00
Artificial Feet and Legs for Deformities, etc.	Cut K 3	"	40.00
	Cut K 7	"	90.00
	Cut K 11	"	90.00
	Cut K 16	"	90.00
	Cut K 17	"	135.00
	Cut K 20	"	90.00
	Cut K 22	"	135.00
	Cut K 25	"	90.00
	Cut K 27	"	90.00
	Cut K 29	"	135.00
	Cut K 31	"	135.00
	Cut K 33	"	135.00
	Cut K 35	"	135.00
	Cut K 36	"	150.00
	Cut K 38	"	135.00
	Cut K 41	"	135.00
	Cut K 42	"	135.00
	Cut K 46	both	210.00
	Cut K 51	each	135.00
	Cut K 54	"	150.00
	Cut K 57	both	270.00
	Cut K 59	"	270.00
	Cut K 61	each	90.00
	Cut K 63	"	150.00
	Cut K 66	"	150.00
	Cut K 69	"	90.00
	Cut K 71	"	100.00
	Cut K 72	"	100.00

PRICES: ARTIFICIAL HANDS AND ARMS

Artificial Fingers for Partial Hand Amputations, described on pages 216 to 219..	Cut P 9	each	$ 40.00
	Cut P 10	"	40.00
	Cut P 23	"	60.00
	Cut P 24	"	60.00
	Cut P 25	"	60.00
	Cut P 26	"	60.00
Artificial Hands for Partial Hand Amputations, described on pages 219 to 220...	Cut P 38	"	60.00
Artificial Arms for Wrist-Joint Amputations, described on pages 221 to 223...	Cut Q 8	"	50.00
	Cut Q 9	"	50.00
	Cut Q 10	"	50.00
	Cut Q 11	"	50.00
	Cut Q 16	"	60.00

Artificial Arms for Forearm Amputations, described on pages 224 to 229........	Cut R 7	each	$ 60.00
	Cut R 8	"	50.00
	Cut R 13	"	60.00
Peg Arms for Forearm Amputations......	Cut R 14	"	40.00
	Cut R 15	"	50.00
Suspenders for Forearm Amputations.....	Cut R 16	"	3.00
Artificial Arms for Elbow-Joint Amputations, described on pages 230 to 232...	Cut S 2	"	100.00
	Cut S 3	"	100.00
Peg Arms for Elbow-Joint Amputations...	Cut S 4	"	90.00
	Cut S 5	"	60.00
Artificial Arms for Above-Elbow Amputations, described on pages 233 to 234..	Cut T 3	"	100.00
	Cut T 4	"	100.00
Suspenders for Above-Elbow Amputations..	Cut T 5	"	3.00
Peg Arms for Above-Elbow Amputations ..	Cut T 6	"	60.00
Artificial Arms for Shoulder-Joint Amputations, described on pages 235 to 237...	Cut U 5	"	125.00
	Cut U 6	"	125.00
	Cut U 7	"	125.00
Appliances for Deformities, Excisions, Weakened Joints, etc., described on pages 242 to 245....................	Cut W 1	"	50.00
	Cut W 2	"	50.00
	Cut W 4	"	35.00
	Cut W 22	"	125.00
	Cut X 1	"	1.00
Arm Implements	Cut X 2	"	1.00
	Cut X 3	"	1.50
	Cut X 4	"	1.50
	Cut X 5	"	1.50
	Cut X 6	"	1.50
	Cut X 7	"	8.00
	Cut X 8	"	3.00
	Cut X 9	"	3.50
	Cut X 10	"	5.00